American Surgical Association Number

Vol. LXIV AUGUST, 1916 No. 2

AUG 10 1916
UNIV. OF MICH. LIBRARY

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

Edited by
LEWIS STEPHEN PILCHER, M.D., LL.D.
of New York

With the Collaboration of
SIR WILLIAM MACEWEN, M.D., LL.D. of Glasgow
SIR W. WATSON CHEYNE, C.B., F.R.S. of London

PREPAREDNESS 129
ROBERT G. LE CONTE, M.D., ... PHILADELPHIA

THE SURGICAL LESSONS OF THE EUROPEAN WAR 138
A. M. FAUNTLEROY, ... WASHINGTON, D. C.

LOCALIZATION AND EXTRACTION OF PROJECTILES AND SHELL FRAGMENTS 151
JOSEPH MARSHALL FLINT, M.D., ... NEW HAVEN

METHODS OF HANDLING INJURIES ON TRANSPORTATION SYSTEMS AND WOUND TREATMENT 184
KENNETH A. J. MACKENZIE, M.D., ... PORTLAND

CHRONIC GENERAL INFECTION WITH THE BACILLUS PYOCYANEUS . 195
LEONARD FREEMAN, M.D., ... DENVER

A FURTHER NOTE ON ETIOLOGY OF SURGICAL SCARLATINA 203
JOHN B. ROBERTS, M.D., ... PHILADELPHIA

MELANOTIC CANCER 206
WILLIAM B. COLEY, M.D., AND JOSEPH P. HOGUET, M.D., ... NEW YORK

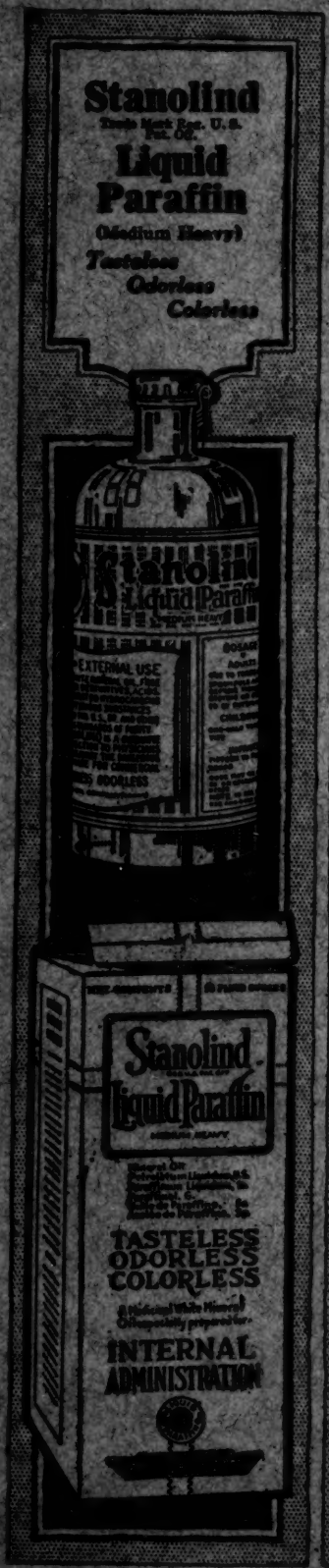
OBSERVATIONS ON THE DIAGNOSIS AND TREATMENT OF TRIFACIAL NEURALGIA 242
E. H. BECKMAN, M.D., ... ROCHESTER

DISLOCATION OF THE FIRST CERVICAL VERTEBRA 248
A. F. JONAS, M.D., ... OMAHA

A METHOD OF TREATING CYSTS OF THE BREAST 254
FRANCIS J. SHEPHERD, M.D., ... MONTREAL

J. B. LIPPINCOTT COMPANY, PUBLISHERS
MONTREAL PHILADELPHIA LONDON

Entered at the Post-Office at Philadelphia and admitted for transmission through the mails at second-class rates.
Price $5.00 a year. Copyright, 1916, by J. B. LIPPINCOTT COMPANY, 227–231 South Sixth Street.



Does Not Deplete the Patient's Strength

by irritating the delicate lining of the intestines and inducing undue peristaltic activity. On the contrary, it conserves strength by lubricating the entire alimentary canal, thus assisting in a more complete evacuation of the bowel content.

This important characteristic of Stanolind Liquid Paraffin is an eloquent illustration of its superiority over salines, aperient waters and purgative drugs, and is, for example, of signal importance in the cases of patients about to undergo an operation.

Stanolind Liquid Paraffin is a safe and dependable agent for continued internal administration.

A trial quantity with informative booklet will be sent on request.

Standard Oil Company
(Indiana)

72 W. Adams St. Chicago, U. S. A.

ANNALS *of* SURGERY

VOL. LXIV AUGUST, 1916 NO. 2

PREPAREDNESS

THE PRESIDENTIAL ADDRESS DELIVERED BEFORE AMERICAN SURGICAL ASSOCIATION, WASHINGTON, D. C., MAY 9, 1916

BY ROBERT G. LE CONTE, M.D.

OF PHILADELPHIA

THERE would seem to be but one fitting subject for the address of the President of the American Surgical Association at this time; a topic that is in every man's mind, that is daily discussed by the press of the country, and which is likely to be the key-note in the selection of candidates for the next Presidential election, namely, preparedness.

What is preparedness? To increase the efficiency of the military establishment of the United States.

Why should this be done? That our citizens may be safeguarded and permitted to enjoy life according to our laws; that we may be protected from foreign aggression or oppression; that the principles upon which our nation was founded shall be maintained in the world; that international law, which no longer exists because it cannot be enforced, shall be re-established, and this will take might as well as right.

If our country is to continue to be a power among nations it must have a trained force commensurate with its power, an army, and, above all, a navy of sufficient strength in ordinary times to make its word respected. For extraordinary times of national peril, it should have at its command a sufficient body of trained citizens to meet that peril and avert it, or overcome it. The art of war is as much a science as the art of medicine, and its changes in the past twenty years are quite as pronounced as those in medicine. It is foolish to suppose that men versed in the elementary rudiments of a science can compete with the trained scientist.

When bubonic plague threatened to invade the United States on the Pacific Coast, did the Government send first-year medical students to combat it? On the contrary, educated laboratory men and scientists of the highest medical ability were sent, and promptly exterminated the threatened invasion of a great plague.

To-day there is raging in Europe the greatest pestilence that has ever visited the earth. It is costing millions of lives, devastating whole countries, impoverishing every nation that is in its grip, and what are we doing to prevent its spread to our shores?

We have a handful of men trained to combat it, and Congress has been debating for a year or more whether we shall double that handful and make it two handfuls. It is like having a few drugs in ounce bottles neatly labelled on a shelf, when tons of medicine are needed.

The present war in Europe has taught the world nothing if it is not the lesson of preparedness. This country has never entered a war in a state of preparedness, but has a lack of preparation ever prevented our going to war? To argue that preparedness for war invites war is as logical as preparedness for an epidemic invites the epidemic. The war in Europe has brought about tremendous changes in national life and, unless we prepare to meet these changes and safeguard ourselves, our present national existence may cease, and we may disappear from the face of the earth as did the mammoth lizards and mastodon, and for the same reason, inability to adapt themselves to the changes in their surroundings.

For more than a year before the European war started, Germany's plans for the invasion of Belgium were decided upon, but not before a careful study had been made of the preparation and defences of both Belgium and Switzerland. What saved Switzerland from destruction was no love for her people or high regard for her nation, but her national policy of universal military training, with the thoroughness of her preparation. Had it been easier to go through Switzerland, the first attack would have been on the Swiss, not on the Belgians. With a population of 3,700,000, Switzerland can place in forty-eight hours a quarter of a million men in the line, and have two hundred thousand more in reserve. They acknowledge the principle that every man owes something to the nation's service, and their military establishment costs about $7,000,000 a year; a cheap insurance from national destruction.

I have heard a great deal of pacifist talk like this: What do you want to prepare for? Who is going to fight us? Do we want this country ruled by the military? etc., *et ad nauseam.* Would any of these people cross the ocean on the finest steamer in the world that lacked life boats and life belts, on the assurance of the captain that no storm or fog, collision or iceberg would hurt the ship? Yet the chances of the vessel reaching its destination safely are surely 100 to 1, perhaps 1000 to 1, on any given voyage. But who can foresee on which particular voyage the life boats will be needed? Put our nation in the

place of this ship, with the captain and officers clamoring for adequate life-saving apparatus. Would any passenger embarking oppose the preparations of the captain? Are we not all in the same ship?—and, because some of us want adequate protection must we be called fools and other things by the pacifists? For many years Lord Roberts advocated universal military training in England. His opponents were always asking, "Whom are you getting ready to fight?" He could not tell then, but they have their answer now.

When the European war ends, the United States is going to have most of the money in the world, and some of the nations in Europe are going to have most of the shells. If we are not prepared with an adequate navy and army, it will be easy to convert shells into money at our expense. In the old days it took two to make a quarrel and a fight, but now one nation when ready can impose war on another, and the pretext is nominal or immaterial.

Unless universal military training is made a national policy, this country will never be prepared to meet a first-class power in conflict. No other system can be considered as more than a make-shift or a stop-gap, a source of delusion, but not of safety. Any attempt to depend upon a volunteer system will fail, admirable as the volunteer spirit may be, for it means the organization for war after war is upon us, and transferring the burdens of war to the time of war, a policy which spells defeat. Universal military training modelled on a system similar to that of Switzerland or Australia is the only logical remedy. It is the basic principle of defence upon which the democracy or representative government rests. It will lead unquestionably to better citizenship, to better physical development, to a reduction of crime, and will give to each man an education which the public schools do not supply, something worth more to the individual than reading, writing and arithmetic, for it will teach him obedience, self-control and patriotism, and does education hold three more important things in the preparation of youth for manhood? This service must be obligatory, one that all men owe the nation during a certain period of their lives. They must understand that military service is like any other service to the nation, if the country is to be successful. A real war, a war with a prepared nation, will not be successfully fought by the United States until that principle is in every man's head and has been acted upon.

The present strength of the medical corps of the army is 443 medical officers and one Surgeon-general. In 1908 this number was authorized upon the basis of an army of 65,000 men. This was on a ratio of .7 of 1 per cent. of medical officers to the enlisted strength. Since the

passage of the above Act the army has been increased about 50 per cent. without any increase in the medical corps. This has reduced the ratio of the medical corps to less than .5 of 1 per cent., a ratio entirely inadequate to the proper performance of its duties, so inadequate that it has had to supplement its personnel with officers from the medical reserve corps and with contract surgeons. The department, therefore, in time of peace is so near the breaking point that it has had to call in outside assistance.

The conflict in Europe has shown that .7 of 1 per cent. of medical officers is not sufficient for war, and that 1 per cent. should be the minimum. Again, the mortality in medical officers has been almost as high as in the line. France, in the first six months of the war, lost 1300 medical officers out of 6500, a loss of 20 per cent. of the staff.

Proper training for a staff corps is just as important as proper training for a line organization. An untrained personnel in the medical corps invites and assures a breakdown in this branch under the strain of war. Disorganization will result, followed by the demoralization that always occurs where one or more branches of an army prove incapable.

The requests for an increase in the medical corps have been met with the argument that such increase was unnecessary, for the reason that in our country there are thousands of medical men who in time of emergency would tender their services. The duties of the military surgeon are vastly different from those of a civil practitioner, and no one in civil life can take the place of a trained medical officer unless he has had that training. The purely professional work can be handled by civilian practitioners, but they cannot fill the supervisory positions which in war, even more than in peace, imperatively demand a thorough familiarity with the process of military administration. Unless medical officers sufficient in number for these positions in time of war are provided and trained in time of peace, when war comes men untrained in military administration must be called upon to fill these places, at once putting the medical department upon a volunteer basis at the very beginning of hostilities, with the assurance of the same demoralizing results that have always followed that procedure.

The available supply of medical men in the United States is decreasing, not only relatively to the population but also in absolute numbers. In the last eleven years the number of medical students has decreased 47 per cent., which, with the relative increase in population, means that to-day we have one graduate in medicine to 28,000 people, while in 1904 we had one graduate in medicine to 14,000. The position the United States is in regarding available medical men is rapidly

approaching the condition that England is now in, not enough practitioners for the civil population and the army. England was compelled to call upon Canada, Australia and New Zealand for large numbers of medical men, and, when this failed to fill up the necessary complement, they turned to us for assistance.

To produce an efficient medical department in time of war, trained officers must be provided in time of peace, in numbers sufficient to form a nucleus for expansion to meet the needs of war. Such expansion cannot be accomplished with trained officers sufficient only for the ordinary duty in time of peace. Failure to acknowledge this principle is bound to bring reproach upon the country, by again producing the conditions that disgraced the first two years of the Civil War, and also the Spanish War. The Spanish War, although a short war, was an example of too few trained men to properly meet the demands of war. The army then was expanded within a few weeks to about ten times its peace strength. The medical department broke down. Civil practitioners volunteered by the thousands but were unable to do the work of the trained military surgeon.

These are the statistics of the shortest and in many ways the most successful war we have ever waged. From the time the Maine was destroyed until peace was declared was about five months. Our deaths from battle were 293; our deaths from disease were 3681, of which 2649 occurred in military camps in the United States, among volunteer troops and recruits who never saw the firing line. If we take the mortality from disease as 10 per cent. it would represent 37,000 cases of illness to 293 deaths from wounds. There are many things which account for these figures, but the most potent to my mind is medical volunteers, untrained in the art of military medicine, camp sanitation, hygiene, etc., associated with volunteer troops who have not the knowledge to care for themselves in the field. Imagine a preparation so inadequate that it made it 10 times more dangerous to live in camp in the United States than to be on the firing line in Cuba.

How can we and the medical profession in the country aid our medical corps? First, by joining the Reserve Medical Corps of the Army or Navy. Second, when your commission is received do not for one moment imagine that makes you a military surgeon, except in name. Study, application, time and money are needed and must be spent in correspondence schools, work in armories with the medical corps of the National Guard, summer instruction camps, etc. What is needed is fitness to take your place in an organized department and not individual brilliancy in your civil specialty. The Department will

supervise your training, but you must do the rest. Third, the formation of units which will be prepared to take charge of a base hospital of five hundred beds. This must be done in affiliation with the Red Cross, as the medical department of the Army has not the authority to make such enrollments. Several of these units have already been formed, but many more are needed.

A committee has been appointed, composed of members of some of our national societies, to inventory the names of the medical men in the country, the hospital supplies, the hospital facilities, etc. You must aid this committee in every possible way and urge upon all good men the importance of joining the Reserve Corps.

The medical personnel in the Navy is 345 officers, with 113 in the Reserve Corps, and the expansion in the Navy will necessarily be limited by the number of ships. The Reserve Corps of the Army has about 1700 officers, and the Surgeon-General desires at least 20,000, for the Army in time of war will be expanded ten, twenty, perhaps fifty times its present number.

Success in war is the result of adequate military preparation followed by effective military operation, and the plans of the general staff for effective military operation are dependent on the medical corps keeping the troops healthy, and the speedy disposition of the sick and wounded. In the Dardanelles campaign the British removed in six months 78,000 sick, and this sickness was perhaps as important as any other factor in the abandonment of the campaign. While others talk preparedness, let the motto of the medical profession be, "We are preparing." And why should we prepare? Because our country needs this service. Because we are almost as important to the fighting line as guns and ammunition. Because our calling makes us ever ready to treat the sick and injured, and to subordinate self to that ideal. Because we are patriotic and true Americans. And what is true Americanism? I will answer this in the words of one of our most gifted writers and loyal patriots (Dr. Henry Van Dyke, Oration Delivered on Washington's Birthday, 1906, at the University of Pennsylvania):

> True Americanism is this:
>
> To believe that the inalienable rights of man to life, liberty, and the pursuit of happiness are given by God.
>
> To believe that any form of power that tramples on these rights is unjust.
>
> To believe that taxation without representation is tyranny, that government must rest upon the consent of the governed, and that the people should choose their own rulers.
>
> To believe that freedom must be safeguarded by law and order, and that the end of freedom is fair play for all.

To believe not in a forced equality of conditions and estates, but in a true equalization of burdens, privileges and opportunities.

To believe that the selfish interests of persons, classes, and sections must be subordinated to the welfare of the commonwealth.

To believe that union is as much a human necessity as liberty is a divine gift.

To believe, not that all people are good, but that the way to make them better is to trust the whole people.

To believe that a free state should offer an asylum to the oppressed, and an example of virtue, sobriety, and fair-dealing to all nations.

To believe that for the existence and perpetuity of such a state a man should be willing to give his whole service, in property, in labor and in life.

That is Americanism; an ideal embodying itself in a people; a creed heated white-hot in the furnace of conviction and hammered into shape on the anvil of life; a vision commanding men to follow it whithersoever it may lead them. And it was the subordination of the personal self to that ideal, that creed, that vision, which gave eminence and glory to Washington and the men who stood with him.

Such was the glorious birth of our Nation,
Our inheritance its perpetuation.

THE SURGICAL LESSONS OF THE EUROPEAN WAR *

By A. M. Fauntleroy
of Washington, D.C.
surgeon, U. S. navy

A critical review of the vast amount of surgical literature which has come into being as a result of the European War brings out the fact that there is a great deal of conflicting testimony on the part of many of the observers who have had more or less close range opportunities to study the surgical conditions of this all but Pan-European struggle. That this should be the case is not surprising when one realizes that, after nearly two years of the war, there have been close on to thirty million men actively engaged in this great carnage of the nations; and, out of this stupendous number, there are at present eighty odd thousand surgeons whose work and observations extend over a battle front of many thousands of miles and under many varying conditions. This number of surgeons represents a fair estimate of the present commissioned personnel of the medical corps of the belligerents, but does not take into consideration the large number of surgeons whose activities have been curtailed by reason of deaths, wounds and disease. Nor does it take into consideration a large number of medical and surgical men who, by reason of age and other causes, are prevented from participating except in a semi-official capacity in their home towns or cities.

It is no small wonder then that from this large number of observers there should arise varying degrees of divergent opinions with reference to the salient surgical problems which have had to be met and solved from time to time. Not until peace has been established, and the professional mind has had an opportunity to thoroughly digest all of the statistical evidence, will the real facts be shown in their true light. Until such time, we shall have to content ourselves with correlating the experiences of these many different observers who are viewing the same general subject from many different angles of observation. From this distillation of the recorded data we should be able to forecast a solution, as regards some of the disputed points, and visualize a more or less accurate interpretation of the surgical lessons of the war.

Certainly the surgery of war is not the surgery of peace, and an acceptance of this fundamental idea is necessary at the outset if we are

* Read before the American Surgical Association, May 9, 1916.

to arrive at a correct understanding of many of the questions which confront the military surgeon in his effort to meet the sudden, and ofttimes overwhelming, demands occurring as a result of a more or less continuous traumatic epidemic incident to battle conditions. In striving to understand this situation, the civil surgeon must begin by realizing that the military surgeon, in order to fulfil his function successfully, must be a specialist in surgical adaptability and compromise. The perspective of the military surgeon is totally different from that of his civilian confrère in that it is paradoxically both broadened and narrowed. Broadened because of the necessity for making continual concessions as regards obtaining the ideal in order to secure the best general results; and, at the same time, narrowed because of the necessarily restricted application of complicated surgical procedures to the circumscribed field of general traumatic emergencies. Although the military surgeon has many other activities besides the practice of surgery, the limits of this paper prohibit a discussion of the problems in hygiene, sanitation, preventative medicine, organization and administration, all of which combine to make military practice a highly specialized branch of the healing art.

In reviewing the surgical literature of the present war, it is quite evident that all medico-military observers agree that the wounds encountered are not only totally different from the surgical experiences of civil practice, but that infection in some form is always to be found in the wounds treated in war hospitals. Disregarding the relatively few penetrating or perforating bullet wounds which do so little tissue damage that they heal spontaneously, the outstanding feature of all serious wounds in this war is the mutilating and devitalizing effect on the tissues due to large and small irregular pieces of metal, the majority of which are fragments of the high-explosive shell and hand grenade. Many of these wounds are of such a mutilating character as to be compared only to the crushing injuries of railroad practice in civil life. Invariably the serious wounds have been found to contain various foreign particles, such as bits of clothing, metal or other foreign material, which undoubtedly accounts in large measure for the universal infection. A large percentage of these war wounds have been compound fractures of long bones, involving usually a considerable loss of substance, so that the surgical problem not only had to take into consideration the treatment of wounds infected with a variety of bacterial flora, but also the development of suitable fixation apparatus in connection with the all-important after-treatment of the case.

As regards the character of the infection encountered in war

wounds, all observers agree substantially that the primary infection has been due practically to a fæcal contamination. In other words, the infection in the early stages was due to organisms which normally inhabited the intestines of men and animals, such as *B. aerogenes capsulatus, streptococcus, B. proteus, B. coli, B. tetani,* and a number of spore-bearing putrefactive anaërobic bacilli, which give rise to the foul odor and all of which are to be found in fæces. A large number of carefully executed laboratory examinations, in conjunction with the clinical evidence, have brought out the fact that the soldier's clothing is practically always the source of this primary wound infection. The original source of the infecting organism is unquestionably the soil of the particular part of the country in which the trenches are dug. The soil of Belgium and northern France has undergone an intensive fertilization for many years and is saturated with the organisms enumerated above. The prolonged and intimate contact of the soldier's clothing with the trench dust and mud accounts for the conditions which make for universal wound infection in underground warfare.

The history of all war wound infections clearly shows that the character of the infection is largely a matter of the composition and condition of the soil over which, and in which, the campaign is being conducted. The dry and uncultivated arid veldts of South Africa, in which there are but few, and ofttimes no, pathogenic bacteria, was responsible for the relatively few cases of serious wound infection which obtained throughout the Boer War. Such would be the case in any other locality in which habitations were few and the general condition of the terrain unsuitable for bacterial growth; so that the study and knowledge of the bacterial content and character of the soil will be the military surgeon's future guide as regards what to expect and what to provide for in any particular campaign.

The course of wound infection in the present war may be divided into three stages: First, there is a gross infection with anaërobic spore-bearing bacilli, producing a foul-smelling scanty discharge due to the action of the bacilli on the blood clot and serum in the wound. Streptococci are also usually to be found in the wounds at this time, although they are not apt to be actively manifest until a later period. Secondly, the anaërobic bacilli gradually diminish over a period of about ten days and the discharge becomes more frankly purulent, although the predominant infection during this period is usually of an anaërobic character. Thirdly, there is usually an active infection with pyogenic cocci dating from two to four days after the reception of the wound.

The best way of combating the infection which has taken place

has been a matter of considerable discussion from time to time; and, even at this date, there is no little dispute as to the correct method which should be adopted in order to secure the best results. Quite a large number of surgeons in this war have been slow to appreciate what has already been stated, namely, that the surgery of war is not the surgery of peace. In war surgery neither the condition of the patients themselves, nor the character of their wounds, is at all comparable with the surgical practice of peace and, in addition to this, the character of the infection is quite different from that in civil life. It must be remembered that the general condition of the patient plays a paramount part in the subsequent healing process of any wound. In the present war, the average patient who reaches a field hospital has had his vitality seriously depleted from a number of different causes. Disregarding the various degrees of traumatic shock which accompanies the reception of all wounds, the military surgeon finds he has to deal with the moderate and extreme effects of exposure, starvation, or physical exhaustion due, usually, to the fact that the patient could not be rescued for some time after being wounded. The resisting power has been greatly lowered from these causes and the patient falls a much easier victim to the ravages of infection than is the case in civil life. It has sometimes happened that certain wounded men have not been rescued until five or six days have elapsed, on account of having fallen between the lines. The exigencies of trench warfare have caused serious and ofttimes fatal delays in conducting the patient to a place where his wounds could be adequately treated. It has often been impracticable to remove the wounded, except at night, on account of attracting the enemy's fire, and every hour's transportation delay, which latter may be due to various causes, means that the ever-present infection is progressively increasing and becoming more firmly established.

This general condition of affairs is totally different from civil practice where a surgeon receives, for example, a crush wound of the thigh for treatment, which has been promptly brought in after the accident, and which is handled throughout under modern aseptic conditions. Immediate and complete attention can be given in civil hospitals to the most complicated wound and the surgeon is not hurried by the knowledge that there are probably many other seriously injured awaiting his attention. In direct contrast with this the surgery of war calls for a series of delays because of the necessarily graded attention to the wounded. Beginning with the application of a first-aid dressing in some protected spot immediately behind the trenches; then, when

opportunity offers, transportation by stretcher bearers to an advanced dressing station, located from a half to one mile in the rear, where the bandage is reinforced and supporting treatment given; on back five or six miles to a field or clearing hospital where each wound is examined, re-tagged, drainage facilitated, antiseptic dressing applied and some form of temporary, or permanent, fixation splint secured to the part. Not until a patient reaches a base hospital, usually from three to five days after being wounded, does he receive as complete surgical attention as his condition demands. This, in short, represents the routine war surgical treatment, and this general working plan has been found by experience to result in less confusion as regards the details to be carried out, and in less detriment to the general welfare of the average patient. The whole system is the result of a compromise, on the one hand, between the ideal treatment of wounds in a well-equipped civil hospital under normal conditions, and on the other hand, the ofttimes overwhelming amount of work to be performed under the very trying conditions of urgent war surgery in the field.

With these facts before us, and the testimony of numerous observers to guide us, we may endeavor to form an opinion as to the proper surgical procedures to be instituted in the wounds of war. As regards the principle of thorough drainage there is no dispute. There have been several variations from the time-honored method of wide incisions, with drainage tubes, into the depth of the wound to prevent the pocketing of pus. The variations have taken the form of either a suction apparatus applied usually to the dependent part of the wound in the hope that, when combined with continuous irrigation, the septic material will be rapidly withdrawn; or it has taken the form of wide open wound exposure to atmospheric air and sunlight. In any event, the main objects accomplished were the prompt removal of the products of infection and the creation of anaërobic conditions in the wound, and these factors alone seem to have been the first and controlling influence in limiting the spread of infection in the surgery of the present war.

There are two schools of thought as regards the use of antiseptics in the wounds, after free drainage has been established, in order to inhibit more thoroughly the growth and activity of organisms which may remain in the wound. One school, headed by Sir Almroth Wright, maintains that the use of antiseptics is not only unscientific but actually harmful in the great majority of cases. This school teaches that the physiological indications in all infected wounds call for rendering the lymph incoagulable, repressing leucocytic emigration and increasing the flow of lymph from the walls of the wound, thereby

mechanically carrying away harmful organisms and necrotic material. This lymphogogic application consists in the use of a hypertonic salt solution (5 per cent. common salt and ½ per cent. sodium citrate) either as a wet dressing or as a continuous irrigation. The other, or antiseptic school, of which Alexis Carrel and Sir Berkeley Moynihan are sponsors, states emphatically that the antiseptic treatment of wounds not only has a distinct, important and continuous rôle in war surgery, but that it offers the only hope of aborting an infective process in the earlier stages of wound infection.

There is a large mass of testimony on both sides. The reports of those who advocate the hypertonic salt treatment are practically uniform and are not difficult of interpretation. On the other hand, the surgical war literature for the past twenty months has been inundated with reports setting forth the value of this or that antiseptic treatment. The entire list of all known antiseptics has been reported upon and, while many of these were quickly discarded, a number remained in active use and afford a basis of comparison with the hypertonic salt method. Quite a number of unbiased investigators have had ample opportunity to test the claims of each school, and the consensus of their published opinions indicate that there is a distinct field of usefulness for both methods, although the great majority of these investigations show a decided leaning towards viewing the antiseptic method as being, in the long run, the more practical of the two. A number of these reports have a tendency to emphasize the value of surgical common-sense in selecting the line of treatment to pursue in a particular case, and that the treatment must be varied according to conditions.

It would seem that the Dakin fluid is the antiseptic of choice among the great majority of those who, at one time or another, have had recourse to the antiseptic method of treatment. This antiseptic fluid, which is a 0.5 per cent. concentration of sodium hypochlorite, is made by dissolving 140 grammes of dry carbonate of soda in ten litres of sterile water. To this is added 200 grammes of chlorinated lime and the mixture is shaken well. After a half hour the supernatant clear fluid is siphoned off into another bottle, through a cotton plug or filter paper, and then 40 grammes of boric acid are added to the clear filtrate. This solution is neutral to litmus, is non-irritating and is the proper strength for wet dressings and irrigations. The solution should be made fresh every three or four days and the dry stock ingredients should be kept in covered receptacles. It is a significant fact that the Dakin fluid is preferred above all other antiseptics by the great ma-

jority of medical officers who are bearing the heat and burden of the day at or near the front, while other methods of treatment receive support on theoretical grounds from those who are mostly associated with a long-distance view of the war situation.

There can be no doubt as to the value of the early use of the Dakin fluid in the large, lacerated and infected wounds of the present war, and from the many published observations, covering a wide range of usefulness in all character of wounds, it would seem as if there were hardly a dissenting voice in acclaiming it the ideal antiseptic treatment. Substantial and convincing data are not wanting to show that, if used within the first ten hours after the wound has been inflicted, it will often sterilize the wound in a comparatively short time, depending, of course, on the size and character of the wound and the general nature of the infection. After the wound has been thoroughly cleaned of all foreign material and the sides of the wound made smooth by trimming away all ragged and necrotic tissue, a number of small fenestrated rubber tubes are introduced into the depth of the wound and the latter lightly packed with sterile gauze. The number of the small tubes to be introduced will depend upon the nature of the wound as regards the direction and number of the diverticula. The object to be attained is that, when the antiseptic is injected into the tubes, which latter extend beyond the outer dressings, it will reach all parts of the wound. The equitable distribution of the antiseptic throughout the wound is somewhat facilitated by having the ends of the tubes covered for several inches with a thick material, such as rough toweling, so that when the antiseptic is injected it will not spurt into the wound but will gradually pass through the toweling which covers the fenestra and the end of the tube. A small quantity of the antiseptic is injected into the tubes every one or two hours so that the gauze in the wound is kept continuously saturated with the solution, or the tubes may be coupled up with a Murphy drip apparatus. This method has proven very satisfactory as a continued treatment on hospital trains when, on account of the exigencies of the war situation, the wounded have had to be transferred from field and clearing hospitals towards the more distant rear. Oftttimes the delay *en route* has been from three to five days, and this method of treatment admits of continuing the use of the antiseptic while travelling with a minimum disturbance of the dressings and wound.

In the base hospitals all dressings are removed every morning and the quantity of the antiseptic is reduced as the wound clears up. A prominent feature of the Dakin fluid, which is emphasized by many, is its remarkable property of dissolving or detaching devitalized or

necrotic material in the wound. This, of course, is extremely valuable when an anaërobic infection predominates as the anaërobes undoubtedly thrive best on necrotic material. The hypertonic salt solution has also proven of great value in detaching sloughs and devitalized tissue, although its continued use is liable to produce pain and an exuberant growth of granulations. The use of the hypertonic salt solution causes a great outpouring of lymph, which in itself is depleting, so that it would be impracticable to apply it to a large group of cases whose vitality and resistance are already considerably lowered.

Summing up all the available evidence, it would seem that one of the prominent surgical lessons of this war is the early, and more or less continued, use of a potent and practical antiseptic with the idea of aborting, if possible, the infective process before it has gained an ascendency over the adjacent traumatized tissue. When it is apparent, from the local and constitutional condition of the patient, that the infection is well under control, the hypertonic salt solution may be used with satisfaction in selective cases, particularly if there is evidence of continued sloughing in the wound. Experimental work is still in progress and there is hope that further developments will disclose an even more suitable antiseptic than the Dakin fluid; but, until reports along this line are forthcoming, there is little doubt but that this antiseptic fluid has given the most decidedly satisfactory results to both patients and surgeons. Moynihan has voiced the sentiments of a large number of practical surgeons in this war by saying: "Every hour that elapses increases the extent, the penetration, and the virulence of the infection. I think, therefore, that the first attack made by a surgeon on a wound received in battle should be by an antiseptic, and the most powerful that it is proper to use. I do not think that Wright's method is applicable, in the worst cases at least. For the condition of the soldiers who have received severe wounds is one of exhaustion, with lowered blood-pressure, cold extremities, feeble pulse, and marked pallor. A few of these patients need infusion before any remedial measures can be attempted, and very many suffer from shock in greater or less degree."

As regards the first-aid packet carried by each soldier, very little information is to be derived from current war literature in connection with a determination of its real value in any of its present forms. The small first-aid packet, with its familiar contents, was launched many years ago when the low velocity bullet wound was by far the commonest war wound. In this wound there was comparatively very little tissue damage, even when compact bone was struck. The advent of

the high-velocity sharp-pointed bullet has entirely changed the aspect of these wounds, particularly since practically all bullet wounds in this war are inflicted at very close range. The average bullet wound of this war shows a progressively increasing destruction of tissue in the path of the projectile, and the secondary missile effect of splintered bone is ofttimes appalling, resulting usually in large explosive wounds of exit with considerable loss of substance. As a consequence, the small pads of gauze in the average first-aid packet afford but little protection to the extensive wound. In addition to this there is no doubt that the majority of present war wounds are due to fragments of the high-explosive shell and hand-grenade. These wounds are usually large, lacerated, multiple and exceedingly destructive so that the small first-aid packet is of little or no use.

When a soldier has been struck down in a trench, unless the wound happens to be in the head, hand or foot, no idea of the extent or character of the wound can be ascertained at the time on account of the clothes which usually cover the wounded part. It is not only impracticable to remove the clothing at this time, but it is still more futile to attempt the application of any first-aid dressing until it can be applied directly on and over the wound or wounds. The soldier lies where he has fallen, usually in the mud or dirt, until a lull in the engagement permits his comrades to remove him to a place of safety, usually a hundred yards or more in the rear. A considerable lapse of time may transpire before the wounded man can be brought to the spot where an intelligent application of the first-aid packet can be made. In the meantime the wound or wounds have become more or less contaminated by the ever-present infection in the mud, dirt, or clothing, which is caked in the wound by the blood. Hence it is that the small first-aid packet has been of little or no value in the primary treatment of the serious wounds of the present trench warfare. The reason that these packets are not discarded is probably due to the fact that they take up but very little space, and doubtless there is a sufficient number of small superficial wounds to warrant retaining them in the soldier's outfit. The larger and more pretentious first-aid dressings are the ones in common use and are regarded as being the only ones capable of preventing further contamination of the wound.

When the clothes over the wound have been removed at the nearest spot where the first-aid dressing can be seriously applied, iodine, poured on the wound and painted on the surrounding skin, has undoubtedly been a valuable adjunct for the reason that the wound contains a variable amount of gross infective material and it would be folly to

FIG. 4.—The vibrating magnet of Bergonié.

seal it up with a first-aid dressing without some effort at disinfection if it be possible to apply it. This is the critical time in the history of every wound. If the wounded man can be promptly removed to an advanced dressing station, and from there promptly transported to a field or clearing hospital, his chances will be greatly improved. It has too often happened, however, that many and serious delays have occurred before a wound has received anything like adequate surgical treatment, and, as a result, infection has usually been widespread by the time the operating surgeon takes charge of the wound.

As regards the operative procedures, there has been a large number of favorable reports on the total excision of wounds. This practice, of course, can only be carried out thoroughly in comparatively small wounds and in certain parts of the body. The same idea applied to the large lacerated and contused wounds means as complete removal of the walls of the wound as is practicable from an anatomical point of view. There can be no doubt that the large and small irregular pieces of metal, which plow their way through the tissues at a high velocity, cause a considerable amount of tissue devitalization in the path of the projectile, and hence the principle of total excision of the wound is surgically sound and eminently satisfactory for the reason that it removes the devitalized walls of the wound which would sooner or later slough and prolong the infective process. Once the walls of the wound have been made as smooth as practicable by the removal of all overhanging edges and the torn pieces of fascia and muscle, not only is drainage complete, but the wound itself is left in the best possible condition to combat the presence of infection. There is also considerable favorable comment in many reports as to the value of keeping septic cases in the open air and sunlight. In many instances it has seemed to have been the deciding factor in increasing the general resistance to the point where the septic condition could be effectually controlled. Even in cold weather, the removal of patients to verandas and porches has been attended by the most satisfactory results.

As regards penetrating or perforating wounds of the head or abdomen, they represent, along with hemorrhage in any part of the body, the class of cases which call for the urgent field surgery. In the brain injuries, a large percentage are moribund on admission to a field hospital and die within a few hours. All tangential and other fractures are operated upon as expeditiously as possible by trephining and the elevation of fragments. If possible the patients are kept for a number of days before transportation to the rear for obvious reasons. There are no complete statistics available but on the whole the results are

encouraging in recent cases, although the mortality is still high as compared to head injuries treated in civil hospitals. The use of the probe is strongly deprecated by many, and the projectile, unless readily accessible, has been left for removal later, after the wound has healed.

In the penetrating and perforating injuries of the abdomen, the field surgical experiences of the South African War seemed to prove conclusively that opium, starvation and rest in the Fowler position yielded better results than treatment by operation. It would seem, from reports, that the contrary is the case in the present war. Where it has been possible for the patient to receive prompt attention the results from operative treatment have been most encouraging in improving the statistics as compared with the expectant line of treatment. Every effort is made to secure these cases for operation promptly, otherwise surgical judgment must be exercised as to the class of cases in which to operate. As Mayo-Robson says: "A clean bullet wound through the abdomen, with small wounds of entry and exit, and without evidences of internal hemorrhage or extravasation, may, if favorably situated, be treated expectantly; whereas a bullet wound with large openings of entry and exit, or with signs of internal hemorrhage or extravasation, and with the absence of liver dulness, should be operated on as soon as possible, if seen early, and the general condition is favorable. As nearly all shrapnel, shell and bomb wounds are septic and produce great visceral injury, operation will give a better chance of success than expectant treatment if the patient is in a fit condition to bear it and the case is seen early. If the case is seen late and peritonitis has already set in, a small incision above the pubes, large enough for the insertion of a drainage tube down to the bottom of the pelvis, and the Fowler position, will give the patient a chance for recovery."

In a recent personal communication, dated April 7, 1916, from Dr. Joseph A. Blake, who is Surgeon-in-Chief of a large surgical base hospital in France, the following statement is made: "I have seen remarkably good work in the first line dressing stations in the English Army situated even in front of the big guns. In one ward of twenty beds established in a laundry, I saw eight cases of intestinal resection for multiple wounds of the intestines getting well, and I firmly believe in an early intervention." As regards cerebral injuries Dr. Blake further states as follows: "One thing I should lay special stress upon is the wearing of the metal helmet. Judging from the wounded coming from Verdun now, there is a much larger percentage of head wounds. Nearly all of these men attributed their escape from death to the fact that they were wearing the helmet; and a very large proportion of

these wounds simply involve the cranium, and the dura is not lacerated."

Another important lesson of the present war, as indicated in a number of reports, is the firm conviction in the minds of all competent observers that the organization for field work must be so perfected that the wounded shall receive complete surgical attention within the shortest possible time. As Carrel has rightly said: "The future of the wounded depends upon the rapidity of transportation and the possibility of treating the wounded as soon as possible." This lesson is finding expression in the establishment of small but well-equipped base hospitals in carefully selected protected spots within a comparatively short distance of the trenches, usually from three to six hours' ride by motor ambulance, and it has been demonstrated that these easily accessible surgical centres have materially improved the statistics of general field surgery. The development of the automobile combination field and base hospital, which contemplates giving complete surgical attention within two or three miles of the front, is a step in the right direction to obviate unnecessary delays in transportation on the principle that if the mountain cannot come to Mohammed then Mohammed must go to the mountain. The automobile has played a most conspicuous part in the present war, and in no other branch of the service has its usefulness been displayed to better advantage than in the medical department where prompt transportation of the wounded is of paramount importance.

Probably the most obvious surgical lesson of the war is the prophylactic use of antitetanic serum, subcutaneously administered, as soon as practicable after the soldier has been wounded. If possible it is given at a field dressing station and this fact recorded on the wound tag with which every patient is provided. At a field hospital the wound tag is carefully examined to ascertain whether or not the antitoxin has been given and if there is any doubt a dose is immediately administered. In the early months of the war tetanus was a rather common sequel in the seriously wounded cases. Since the routine use of the antitoxin for a year and a half there have been practically no cases of tetanus treated in France or England. In contrast to the success attending the prophylactic use of this antitoxin there have been numerous reports recording the failure of other sera or vaccines as a means of combating certain other wound infections. The one exception to this is several reports which give very encouraging results following the early administration of antistreptococcic serum in some of the badly infected cases. It would seem that the prophylactic use of these measures has a much more potent effect than any curative properties they may possess. Sir Watson Cheyne has suggested that bacteriologists have a great op-

portunity at the present time, and that they may be profitably employed in raising the immunity of new recruits in training camps against all the ordinary bacteria which occur in wounds received in war time.

The recognition of the great value of a surgical dental department in every base hospital is certainly one of the prominent lessons of the war. In conjunction with the regular surgical services, the dental surgeon has proved himself indispensable as regards the treatment of all wounds involving the upper or lower jaw. Time does not permit of entering into a discussion of the various plastic principles which govern the combined surgical and dental treatment of these very distressing wounds. Accurate descriptions of the various steps in the technic have appeared in print from time to time, and these reports would seem to indicate that every case, however badly mutilated, can not only be greatly benefited, but, in many instances, a practically perfect result can be obtained.

There is yet another valuable department which is being added to every base hospital, and which is now regarded by many as one of the essential features in the organization for treating the seriously wounded. This department has to do with the making of all splints and special apparatus in connection with fractures of all kinds. While various well-known methods and splints have been used successfully in the treatment of many cases, yet many of the complicated compound fractures have had to be treated by the use of apparatus specially devised to suit the needs of the individual case. All of these cases, on account of the infection which is invariably present, have to be dressed at intervals and any apparatus which is used has to take into consideration the all-important after-treatment of the case. The surgeon who has charge of the case indicates to the head of the special apparatus department the general character of the splint he desires to use on any particular case. This may be done before operation, or even at the time of operation, when certain measurements can be made and the splint delivered in a remarkably short space of time if the department is well organized and equipped for this special work.

On account of the fact that the surgeons in the field rarely have an opportunity of seeing the end results following any particular treatment they may have started, and whether or not their work is successful, Sir Almroth Wright has suggested the formation of boards of medical officers who would meet from time to time at various points along the line and not only correlate the experiences of the field and base hospital surgeons, as regards the surgical lessons of the war, but who would be able to promulgate much useful information as to the most

efficient manner and means of treatment. It is true that the advantages or disadvantages of certain methods filter slowly, and in the course of time become more or less common knowledge, but it is also true that during this period of slow dissemination of knowledge the wounded are the ones who suffer, and the country is not getting the best results from its medical department because of a lack of system in passing along profitable information. As it stands to-day, many of the valuable lessons will not be recognized as such until after the war is over and the opportunities for practicable application long passed.

I cannot close this paper without giving expression to the fact that any one who has had an opportunity of observing this war at close range is imbued with the reality that the general after-effects will be the most mutilating and devastating that the world has ever known. When this crimson chapter in European history is closed, and those of the present generation who are left strive to orient themselves amid the vast display of economic and material ruin, they will be confronted on every hand by the presence of the lame, the halt and the blind, whose pathetic existence will but continuously echo the world's disgust for war. Despair and misery will be their heritage for many years to come, and so far-reaching will be the pitiable consequences of this titanic effort to destroy the tablets of civilization that progress will wear the ghastly scar for ages.

REFERENCES

H. D. Dakin, D.Sc.: On the Use of Certain Antiseptic Substances in the Treatment of Infected Wounds. British Medical Journal, August 28, 1915.

Cuthbert Wallace, Colonel R.A.M.C. : A Preliminary Note on the Treatment of Abdominal Wounds in War. Journal of the Royal Army Medical Corps, December, 1915.

A. W. Mayo-Robson, Colonel R.A.M.C.: The Treatment of Gunshot Wounds of the Abdomen. British Medical Journal, December 4, 1915.

Surgeon General Sir Anthony Bowlby, A.M.S.: The Bradshaw Lecture on Wounds in War. British Medical Journal, December 25, 1915.

H. M. W. Gray, Colonel, A.M.S.: On the General Treatment of Infected Gunshot Wounds from a Clinical Point of View. British Medical Journal, January 1, 1916.

A. Distasco, D.Sc.: Flora of Wounds and Flora of Putrefaction. The Lancet, January 8, 1916.

Robert B. Osgood, M.D.: Orthopædic Work in a War Hospital. Boston Medical and Surgical Journal, January 27, 1916.

Surgeon General Sir George H. Makins, R.A.M.C.: On the Vascular Lesions produced by Gunshot Injuries and their Results. British Journal of Surgery, vol. iii, No. 11, January, 1916.

Sir W. Watson Cheyne: On the Treatment of Wounds in War. British Journal of Surgery, vol. iii, No. 11, January, 1916.

Percy Sargent, Lieut. Colonel R.A.M.C., and Gordon Holmes, Lieut. Colonel R.A.M.C.: The Treatment of Penetrating Wounds of the Skull. British Journal of Surgery, vol. iii, No. 11, January, 1916.

Beth Vincient, M.D., and Robert B. Greenough, M.D.: Gunshot Wounds of the Soft Parts. Boston Medical and Surgical Journal, February 3, 1916.

H. M. W. Gray, Colonel A.M.S.: Observations on Gunshot Wounds of the Head. British Medical Journal, February 19, 1916.

Sir Berkeley Moynihan, Lieut. Colonel R.A.M.C.: The Treatment of Gunshot Wounds. British Medical Journal, March 4, 1916.

A. Mackensie Forbes, Major C.A.M.C.: Notes on War Surgery. British Medical Journal, March 11, 1916.

Cuthbert Wallace, Colonel R.A.M.C.: A Tabular Statement of 500 Abdominal Gunshot Wounds. The Lancet, March 4, 1916.

G. Grey Turner, Major R.A.M.C.: The Importance of General Principles in Military Surgery. British Medical Journal, March 18, 1916.

C. W. G. Bryan, Captain R.A.M.C.: The After-treatment of Amputation Stumps. British Medical Journal, April 1, 1916.

John S. B. Stopford, M.D.: Gunshot Injuries of the Peripheral Nerves. The Lancet, April 1, 1916.

John Fraser, Captain R.A.M.C., and H. T. Bates, Captain R.A.M.C.: Penetrating Wounds of the Abdomen. British Medical Journal, April 8, 1916.

Earl V. Morrow, M.D.: War Surgery and Treatment. Northwest Medicine, April, 1916.

Joseph A. Blake, M.D.: Personal Communication, April 7, 1916.

Sir Almroth E. Wright, Colonel R.A.M.C.: Wound Infections. William Wood & Company, 1915.

LOCALIZATION AND EXTRACTION OF PROJECTILES AND SHELL FRAGMENTS*

By Joseph Marshall Flint, M.D.
of New Haven, Conn.
professor of surgery, yale university

(From Hôpital 32 bis Château de Passy, Hôpital Francais de New York, Fondation Fitzgerald)

There have been great differences of opinion expressed by military surgeons concerning the advisability of extracting or leaving projectiles or shell fragments either before or after they are healed in the tissues. On the theory that these foreign bodies are a source of danger to the host from the possibility of infection, one group maintains that they should always be removed, while another holds that extractions should be performed only in the face of very definite indications. From the general principles of surgery, it appears far more rational to support the latter view, and, accordingly, we may formulate the definite indications for extraction as follows:

1. Instances where the projectile or fragment forms a focus of suppuration which will probably continue until either the fragment is removed or until it is discharged spontaneously from a fistula.

2. Instances where the foreign body is causing pain. This may be situated either in the muscles, near bones or nerves, in tendons or even superficially. Not infrequently the pain may be due to the cicatrix surrounding the fragment rather than to the fragment itself.

3. Instances where the wounds of entrance or exit have healed, leaving the projectile in the tissues surrounded by a small abscess or focus of infection encapsulated from the surrounding tissues.

4. Any interference with the function of the tissues or organs forms a rational indication for a removal of the offending foreign body.

5. Instances where the presence of the foreign body may influence the mental condition of a patient to a degree which justifies its removal.

6. Another group of cases which are of great importance in military surgery belong to the malingering type, that is to say, wounded who claim that small shell fragments or projectiles are painful in order to avoid the responsibility of further military service. In cases of this group, it is often difficult or impossible for the surgeon to determine the truthfulness or falsity of the patient's statement. I have seen repeatedly cases where I was convinced that the pain would cease on the day of

* Read before the American Surgical Association, May 9, 1916.

the declaration of peace. Such instances, however, require extraction in order to restore the wounded man to active service.

7. Cases where a lead projectile may give rise to lead poisoning. There have been, apparently, a few well authenticated cases of this type.

8. When cases are brought in fresh from the front and operations are performed for infections, better drainage, removal of loose bone fragments in compound fractures, etc., the projectiles should be removed if possible.

In contradistinction to these definite indications for operation, there are certain contra-indications which we perhaps too often forget in the rush or enthusiasm of a military hospital. These may be briefly summarized as follows:

1. No operation should be performed which does more injury to the tissues than the presence of the foreign body.

2. The operations should not be performed in clean cases where there is not a reasonable expectation of aseptic healing or a great probability of finding the projectile.

With definite indications and contra-indications for operative work of this character before us, it may be well to consider for a moment the current methods of localization with particular reference to those that we found useful in Hôpital 32 bis Château de Passy (Fondation Fitzgerald).

Radiography as a Localizing Method.—The use of X-ray plates may be dismissed with a word, for anyone who has had experience with this method realizes that ordinary radiographs even when taken in two or more directions yield, from the topographical and localizing stand-point, insufficient data upon which to base a well planned operation. The percentage of failures in removing the projectiles by their use is very high. A number of cases were sent to us which had been operated on two, three, or four times unsuccessfully where plates had been the sole localizing aid of the operator. On the other hand, plates are of great value as an aid in determining the presence or absence of small shell fragments which might be overlooked with the fluoroscope.

I have had no personal experience with any methods like the Mackenzie-Davidson, where the depth of the foreign body is determined from known points on the skin by calculating the distance from shadows of the projectile made by double exposures on the same plate. I have been told, however, by those who have employed this technic, that it is difficult to do the extractions with the data furnished, owing to the possibility of large errors of computation due in part to the elasticity of the skin.

Operations Directly Under the Fluoroscopic Screen.—We performed some operations with this method of localization, but abandoned it promptly, owing to the fact that it is open to two serious objections, namely: The difficulty of maintaining asepsis in the dark which, however, is not an insuperable obstacle, inasmuch as a surgical technic can be devised which will practically eliminate the danger of infection. The second drawback, however, is one based on the fundamental principle that the screen reveals clearly the foreign body that is to be removed and only vaguely the tissues which have to be conserved. It likewise does not differentiate in the soft parts between structures of importance and those which are negligible. By this method accurate surgery is impossible; the tissues have to be more or less torn and lacerated, so that injuries of the nerves, blood-vessels, and other structures may easily occur, owing to their relative invisibility. This, of course, is not the case in open operation in a good light where the structures are divided under the eye of the operator. Furthermore, screen operations cannot be practised in regions of the body where there are structures of great importance, like the neck, chest, or abdomen. The method is limited at best to operations on the extremities and to parts like the forearm or leg where tissues are readily separated in a longitudinal direction. It is quite obvious, then, that this localizing technic cannot survive in view of other more practical and accurate systems which have been developed during this war, even when the latest improvements in the method are employed, where the operations are performed under a red light and the fluoroscopic screen is used intermittently to control the search for the foreign body. It is evident that the difficulties of operating in the fluoroscopic room and the obstacle of providing adequate illumination for major procedures are really insurmountable for the ordinary military hospital.

The Ring Compass.—This well-known method provides for the operator localizing data in the form of marks on the skin at the level of the foreign body representing the ends of two or more imaginary diagonals that pass through the projectile. These diagonals, as they are usually taken, run at right angles to each other. To obtain these marks compasses shaped something like a pelvimeter are employed, which have on their ends small rings about 15 mm. in diameter (Fig. 1). The patient is placed under the fluoroscope and the projectile centred by diaphragm to eliminate the oblique rays when the compasses are applied, so that the foreign body lies exactly in the centre of the two rings, one of which is on either side of the part of the body in which the foreign body lies. By means of a skin pencil or a special marker, signs are made

in the middle of the rings which are held carefully in position during the removal of the fluoroscope. The part containing the projectile is then moved through an angle of 90 degrees and the process repeated. In this way, four points are obtained on the skin which represent the ends of intersecting lines passing through the projectile. These serve the operator as his localizing guides, but the exact depth of the foreign body is still a mere matter of approximate conjecture.

The Irvin Profondometer.—During our work in improving the

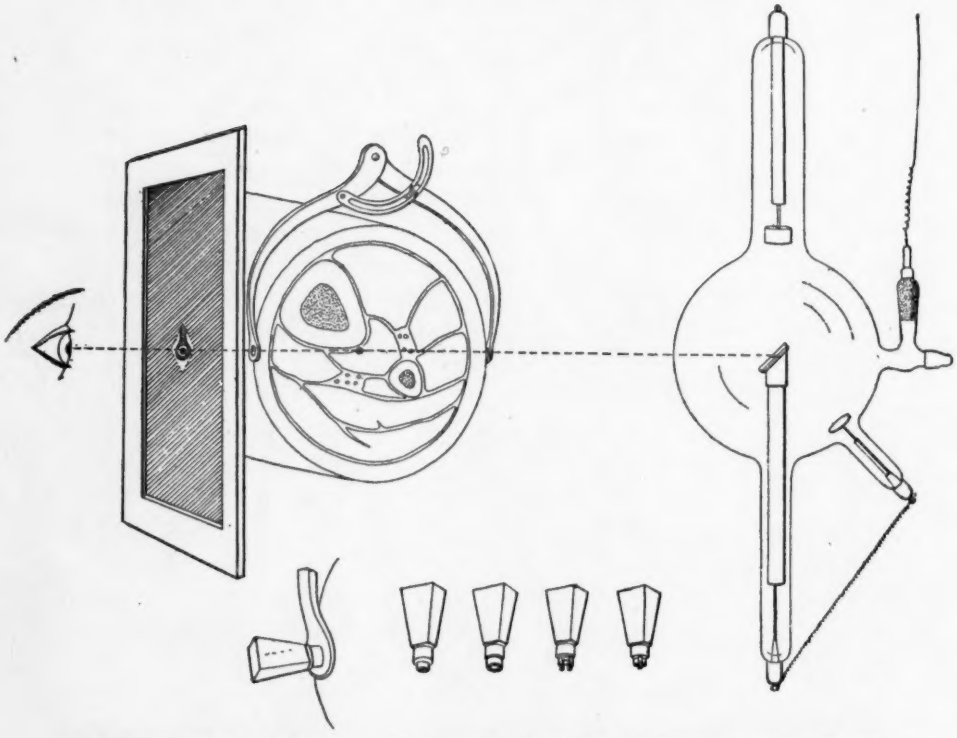


FIG. 1.—Diagram showing the use of the fluoroscope and the ring compass to obtain the diagonals passing through the projectile and the stamps to mark them on the skin.

methods of localization, my assistant, Dr. John Irvin, suggested the use of a very simple and effective profondometer which we find on searching the literature is based on a principle that has been previously used for determining the position of foreign bodies in the cranium. The old method consisted in localizing by means of a compass and then placing a band of supple metal around the head and transferring the marks obtained by the compass to the band. This was slipped off the head and placed upon a piece of paper, where a tracing was made of its outline together with the position of the compass points. The intersection

of the lines connecting the corresponding points gave the position of the foreign body. As will be seen readily, this method was not applicable to any other part of the body than the head, from which the band of metal could be removed without distorting its form. A similar improved profondometer was employed by Warluzel and Jolant and later modified by Tuffier, who used the flexible band of metal with the addition of a hinge to prevent distortion as it is removed from the body. The metallic band in Tuffier's profondometer is pierced by holes, which are employed to determine the points of emergence and exit of the rays passing through the projectile. These are marked and, after the profondometer is removed, wires or small rods are placed in these particular holes, giving at their point of intersection the position of the projectile.

The profondometer consists of a band of malleable metal, such as tin, lead or aluminum, with a hinge in the middle. This permits the localizer to be placed in any part of the body, moulded carefully, and to be removed without distortion. They are made in various sizes, so that they may adapt themselves to a finger as well as a chest, pelvis or abdomen, the proportion of the width to the length from one end to the hinge being roughly one to fifteen. They cost but a few cents and can be made by anyone with a little mechanical ability. The idea involved in this method of localization is to obtain on paper a life-size cross-section of the part of the body at the level of the projectile into which the important anatomical structures can be sketched and which has the position of the foreign body indicated accurately with reference to the skin surface. From these graphic tracings, the operation can be planned and the incision selected. Such a tracing also serves as a control for measurements during the operation.

In making the localization, the patient is placed under the screen and the compass method employed in the ordinary way. We have multiplied the number of observations, usually taking four and sometimes six or eight, in order to increase its accuracy. In making the marks on the skin in the compass rings, an ordinary rubber stamp pad is used with small stamps whittled out of wood to give distinguishing characteristic marks like dots, crosses, diamonds, squares, etc., which are not easily confused after the compass localization is complete (Fig. 1). Small rubber stamps with numbers or letters may also be employed as the indicators. In any case, the stamps, either rubber or wooden, should be short in order to facilitate placing the marks in the ring situated at the dependent part of the body just above the X-ray table. It is, of course, obvious that the two marks made at each compass observation should correspond. In case of doubt from the blurring of the marks, the

blurred observation is discarded and only the diagonals that can be identified with certainty are placed upon the chart. The patient is placed parallel to the surface of table and elevated by blocks when lying down, some two or three inches above it, to facilitate the application of the compasses and the marks on the lower side. In cases that are ambulatory, localizations of the chest and abdomen can be made most conveniently in the erect posture.

After the skin marks are obtained, the function of the profondometer is to give a contour line of the skin at the level of the foreign body, making it possible to convert the imaginary diagonals represented

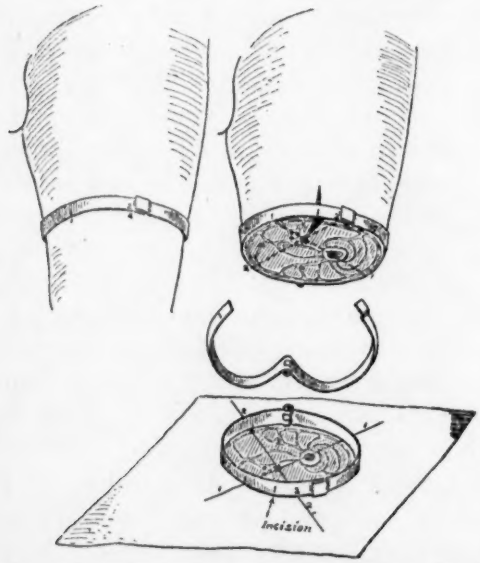


FIG. 2.—Diagram showing how the profondometer is employed to make the cross-section charts and its use in indicating the exact position of the incision.

by the compass marks into real diagonals, thus localizing accurately the foreign body in the horizontal cross-section with reference to the skin surface. This is done by placing a profondometer of suitable size (Fig. 2) with the hinge at the midline behind at the level of the part where the skin marks are found, as these always lie in a horizontal plane. This is very carefully moulded to the contour of the body and a mark is made at the point where the branches of the instrument overlap. The marks on the skin are then accurately transferred to the profondometer and the latter is carefully removed and placed upon a sheet of paper. The outline representing the skin contour is then traced together with the position of the skin marks. The profondometer is

thereupon removed from the paper and the corresponding points obtained by the compass are converted into real diagonals by a ruler, so that we have the exact position of the projectile indicated at the point where the lines intersect. Finally, the important anatomical structures can be sketched into the cross-section, a procedure which is greatly facilitated by the aid of a good cross-section anatomy like that of Eyclesheimer and Shoemaker, for example. It is now possible with these data to plan the operation and select the incision with reference to surgical and anatomical considerations, which is then marked on the tracing. By means of the profondometer, the position of the incision can be transferred to the skin surface of the body by first marking it from the tracing on the instrument and then replacing the latter on the body in its original position and making a corresponding mark on the skin. The tracing may then be used to obtain exact measurements from the incision to the projectile. The various stages of the application of the profondometer and the method of obtaining the tracing are shown in Fig. 2. It is important to remember in obtaining cross-sections of large regions of the body, like the chest or abdomen, where there may be some distortion of the profondometer from the spring in the metal which might lead to a slight error, it is well to control the anteroposterior and lateral diameters of the section under examination. This is done most easily by checking up these dimensions as the profondometer is placed on the paper. The measurements are most readily taken by the compasses which can be fixed by a set-screw shown in Fig. 1, which I have added to the original instrument for this purpose.

There are several parts of the body where the localization has to be modified. The way I have met these problems will be discussed with the cases in which they occurred.

The Sutton Localizer.—This is an excellent method which is very easily employed and has relatively few limitations for localizations in the extremities. It cannot, however, be used for projectiles in the neck, chest, or abdomen. The method as originally devised by Sutton consists in the introduction of a special cannula or trochar under the skin by the aid of the fluoroscope. The cannula is employed to leave a fine piano wire with a crochet end lying adjacent to the foreign body to serve as an operative guide.

At our hospital the following technic is employed: The general position of the projectile is determined by means of radioscopy or radiography and the profondometer to give the line of incision. The field of operation is disinfected with iodine and covered with sterile towels. The operator in sterile rubber gloves injects the skin and path of the

cannula with novocaine. The skin is perforated with the pointed trochar which is immediately replaced by the blunt obturator. At this point the hands of the operator are covered with a sterile towel and the fluoroscope employed to pass the cannula under direct vision down on to the projectile which is touched and moved by it. Should vessels or nerves of any size be encountered, they are pushed aside and not perforated by the blunt end of the obturator. As soon as the projectile or shell fragment is touched, the light is turned on, the sterile towels removed, and the obturator withdrawn from the trochar and replaced by a very fine steel wire with a crochet end, so that on the withdrawal of the trochar this fine wire is left anchored in the tissues at the exact point of the fragment. The patient is then transported to the operating room and the operation performed with this fine wire serving as a guide. This last stage of the method, however, in our experience was open to certain objections, the principal one being the fact that the wire is too fine to be felt easily and is too small to be seen with any degree of distinctness, especially when the field of operation is stained with blood. I have accordingly modified the method by substituting for the fine wire an obturator, which just fits the trochar, armed with a small harpoon (Fig. 3) at the end. This opens after it leaves the trochar and has the double advantage of not only giving a firmer fixation in the tissues, but also is thick enough to be felt and seen easily during the operation. This consists simply of a thorough infiltration with novocaine, after which the skin is incised and the harpoon followed down to the foreign body. The method of inserting the Sutton localizer together with the harpoon is shown in Fig. 3. For most extractions in the extremities this method is very useful, although we have never employed it alone, but always in combination with the profondometer, which gives the operator exact data concerning the position of the projectile and allows him to insert the harpoon at the point of the best incision selected from anatomical considerations. It cannot be employed in the chest or abdomen or in the neck for fear of injuring important structures.

The Vibrating Magnet of Bergonié.—Another popular localizing method in France at present is that of the vibrating magnet of Bergonié (Fig. 4). The principle on which this magnet operates is well known; it uses an alternating current which is interrupted several hundred times a minute and causes magnetizable projectiles to dance in the tissues. While the method is excellent for shell fragments or for the chemise of German balls, it does not exert any influence upon copper or lead, or other substances which are not magnetizable. This makes it useless in searching for shrapnel balls, for the lead core of balls which

have lost their jackets, or for the copper French balls. It furthermore is also useless even for magnetizable balls or shell fragments situated in bone or covered by dense fibrous tissues which do not transmit the vibrations or do not allow fragments to move.

In its accuracy, it does not compare with the use of the profondometer as a means of localization, but it is particularly helpful in cases fresh from the front, which have either fractures or infections that sometimes render the manipulations necessary in the profondometer

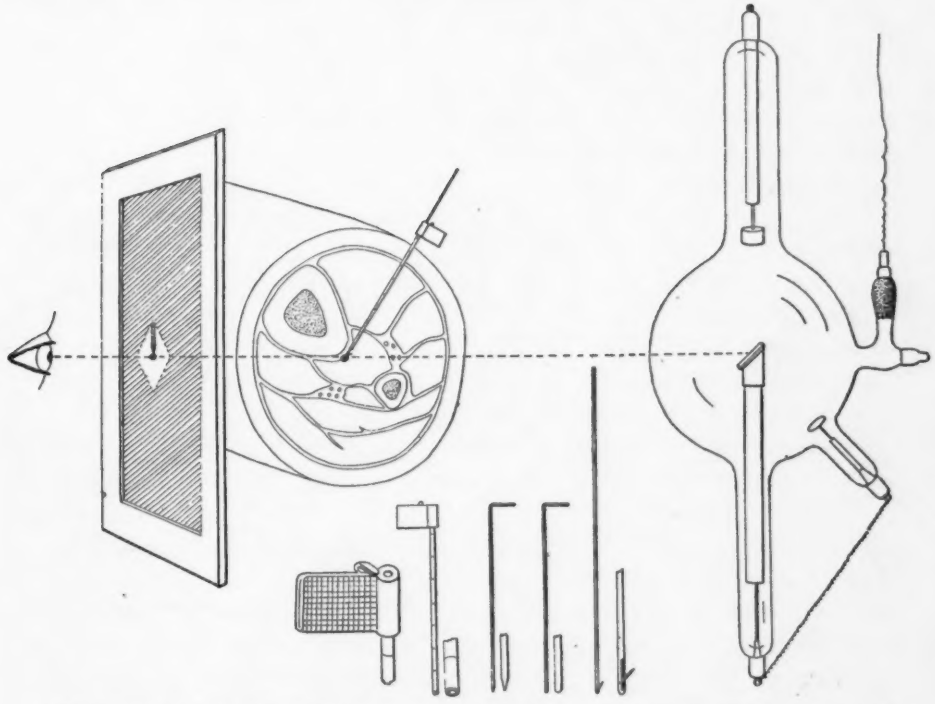


FIG. 3.—Diagram showing the Sutton cannula and trochar and the harpoon, as well as the way in which they are used.

method too painful for the patient to bear and where operations are often necessary to remove bone fragments or facilitate drainage. The percentage of extractions is much higher during these operations if the magnet can be employed.

Unfortunately, it is only possible to use it with the alternating current. In our hospital where we were supplied with a direct current, the transformation of the latter by a commutator made the resulting alternating current too weak to operate the magnet successfully.

The consideration of each one of these methods of localization shows

that they all have their drawbacks and that no one is in itself perfect. In the frequent discussions of the relative superiority of one method over another, we have apparently lost sight of the fact that the ideal procedure is a combination of several methods by which the errors of one may be corrected by another. While one method may be adapted for one part of the body, the other may be either useless or dangerous at this point. The most accurate methods, furthermore, require manipulations which are not readily borne by those suffering from recent gunshot wounds. These facts are well illustrated in some of the succeeding cases.

In general, the procedure of localization in Hôpital 32 bis has been as follows:

(1) Radiography for record and the determination of the presence or absence of very small fragments.

(2) Compass localization.

(3) The use of the profondometer for the determination of the depth of the projectile or fragment from the skin incision as well as its relation to important anatomical structures.

(4) The use of the Sutton localizer with the harpoon guide in suitable cases.

(5) An effort was made to employ the Bergonié magnet in recent cases, but this frequently failed from the lack of a current of sufficient strength to operate it effectively. In many instances the shell fragments or projectiles were found in course of the routine operations by digital search alone, aided by simple radiographs.

With these combined methods of localization, we have been able to obtain an astonishing accuracy and to remove according to the indications laid down above every shell fragment or projectile which it seemed desirable to extract, with a minimum of trauma to the tissues and a maximum of safety to the patient. In fact, with the methods outlined above, the extractions became in the majority of cases simple minor operations, only those in the chest, abdomen, or neck being at all formidable. At least 80 per cent. of the extractions were done with local anæsthesia. In the following cases, which are arranged first by methods and then by the regions of the body, the adaptability of the combined methods to locate foreign bodies anywhere is clearly shown.

CASE I.—Admitted June 19, 1915, with the diagnosis of foreign body in the knee-joint.

Wounded March 10 by shrapnel. Well-healed wound of entrance on the internal aspect of left thigh 4½ cm. above knee-joint over the internal hamstrings. No wound of exit. There is fluid

in knee-joint; floating patella. All motions of the joint are painful, but are not limited. No locking in the joint. The radiograph shows a shrapnel ball in the external condyle close to the intercondyloid notch and the joint surface. Localization by the compass indicates that the ball is about 2.8 cm. from the lateral and 1 cm. from the posterior margin of the external condyle just adjacent to the intercondyloid notch and the joint surface. The position of the ball is well shown in the two tracings of the knee made by the fluoroscope (Figs. 5 and 6).

Operation (August 12).—Incision over the lateral aspect of external condyle anterior to biceps tendon. Approach was down-

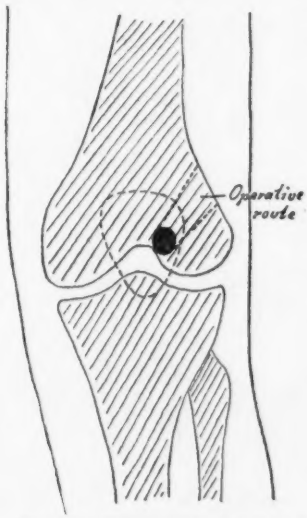


FIG. 5.—X-ray tracing of Case I (anteroposterior view).

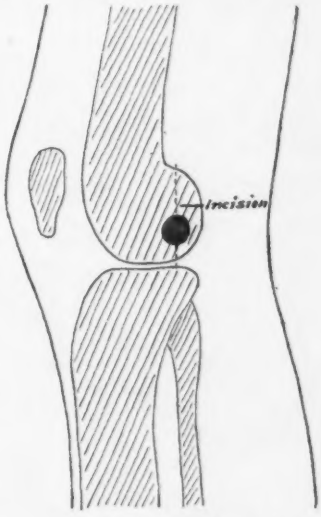


FIG. 6.—X-ray tracing of Case I (lateral view).

ward and inward towards the points determined by the compass localization in order to avoid opening the capsule of the joint. The bone was removed by means of Hudson drills. The greatest caution had to be exercised in drilling the bony channel towards the intersecting point of the two imaginary diagonals indicating the position of the ball, owing to the fact that it is very easy to deviate from the proper plane from the lack of any definite indicator except the skin points obtained by the compass. At the point localized, there was some light-colored tissue like that of the cartilage of the joint. To avoid the possibility of opening the joint this was pricked with a needle and some clear, straw-colored fluid escaped, but nothing was felt suggesting the ball. The needle penetrated for a distance of 1 cm. and appeared to be entering the joint cavity. This process was repeated several times with exactly

the same result. The opening of the bone was enlarged somewhat without finding the foreign body, so that finally an incision was made in this soft tissue where the spherical ball was found perfectly movable in its encapsulating wall. Each time the needle was passed it would slip off of the shrapnel ball and pass down beside it, as is shown in the diagram (Fig. 7). The bone surrounding the ball was removed to some distance and the latter extracted. The wound was closed without drainage; the dead space being allowed to fill with blood clot.

This case is particularly interesting because of the marked mobility of the shrapnel ball after having been encapsulated within the bony condyle. The appearance of the cyst wall, the fluid which

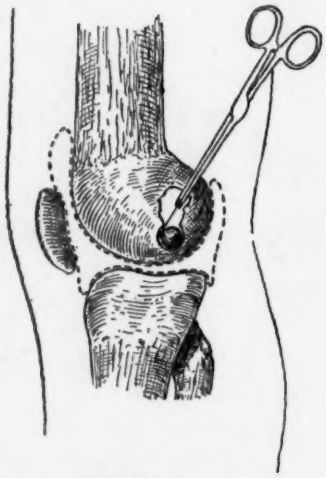


FIG. 7.—Diagram showing the encapsulation and mobility of a shrapnel ball in the femur (Case I).

followed the needle puncture, and the penetration of the needle without resistance made it appear at first sight that the localization had been inaccurate, and that the periarticular tissues were exposed. The ball traversed the popliteal space without injuring either nerves or vessels.

September 1: Wound healed *per primam*. Mobilization started with an adjustable inclined plane; flexion to a right angle obtained.

September 30: Patient started on mechanotherapy. Joint still somewhat stiff. Voluntary movements to an angle of 90 degrees possible.

October 1: Patient walks with a slight limp and has still slight pain on extreme flexion.

November 20: Recovery is practically complete. Still some stiffness from long disuse.

CASE II.—Admitted May 14. Wounded by shell explosion. Laceration of ring finger of the right hand with fracture of the proximal phalanx, also penetrating wound on the dorsal aspect of the forearm over the middle of the ulna. Wet dressing, rubber tissue drains. The X-ray examination shows a fracture of first phalanx of the ring finger with foreign body on the flexor aspect. Incomplete fracture of the ulna with two shell fragments of considerable size near by.

Operation (May 16).—Wound over the forearm enlarged; moderate amount of pus found near the bone; one shell fragment removed, the other could not be found. Small *éclat* extracted from the outer aspect of the ring finger.

July 17: The wound on the finger has healed and the fracture united in good position. There is still some suppuration from the incision from the first operation in the forearm. After compass localization the second fragment was found lying just in front of the interosseous membrane near the ulna. With the assistance of the marks obtained by the compass localization the second fragment was found with considerable difficulty lying immediately behind the median nerve about the middle of the forearm near the focus of osteomyelitis in the ulna. There is often difficulty in following the imaginary diagonals when one passes into the depths of the tissue. Owing to the retraction of the wound edges the maintenance of the plane of incision in exact alignment with the marks upon the skin is not easy. The sinus on the dorsal aspect of the forearm leading to the ulna was enlarged and a small sequestrum removed.

September 3: Suppuration continues from the dorsal incision; that on the palmar aspect has healed.

October 3: Both wounds have healed.

Comment.—These two cases show that the compass method of localization, while possessing a distinct advantage over the use of radiographs alone, still gives the operator considerable difficulty in finding projectiles or shell fragments which may be small or deeply placed, owing to the fact that a slight deviation from the lines of the localization may necessitate considerable operative traumatism before the foreign body can be finally located. On this account the next series of extractions were attempted directly under the fluoroscope.

CASE III.—Admitted August 10 from the dépôt at Sens. Wounded June 21, 1915, by shell explosion. The penetrating wound of the left forearm healed after considerable suppuration in six weeks. There is considerable pain on flexing the wrist and

fingers. He has had two operations; at the first a small shell fragment was removed, and at the second the projectile was not found.

Surgical Condition.—There is a small scar over the dorsal surface of the ulna at the junction of the lower and middle thirds over on the palmar surface of the forearm. Just above this level are two small scars of the previous operations which are painful. Flexion and extension of the wrist cause great pain. There is no disturbance of sensation. Shell fragments or projectiles in the flexor are much more painful than those in the extensor region; probably due to the greater motion and greater power of the flexor group of muscles and tendons. This condition is quite frequent in wounds of the forearm.

Operation (August 23).—Under the fluoroscope. No fragment could be seen in the neighborhood of the scars. One was found about 4 cm. from the incision which could be moved by pressure and was embedded apparently in the flexor sublimis digitorum muscle, the motions of which it followed. The field of operation was prepared and an incision about 3 cm. long made in the skin and subcutaneous tissue. The field of operation was covered with a sterile sheet and fluoroscope used. Under the direct vision of the fluoroscope the muscle fibres were separated in the longitudinal direction until the fragment could be moved by the grooved director which was used for this purpose. A Kocher clamp was then employed and the blades opened when the fragment was touched and the shell fragment withdrawn.

This process, however, is not as simple as it sounds, and a considerable amount of laceration of the tissues was necessary in order to arrive at the exact position of the foreign body, owing to a lack of stereoscopic vision.

Comment.—Several operations of this type were performed, but owing to the fact which has been discussed above, that this mode of operating is not rational from a surgical stand-point inasmuch as the tissues have to be lacerated, it was abandoned in favor of other methods.

With the experience gained in these and other cases, we proceeded to develop the profondometer and the harpoon modification of the Sutton localizer.

The combination of these two methods proved so accurate and convenient that almost all of the extractions which were done subsequently were carried out by these combined methods of localization. The harpoon naturally cannot be used in the chest, neck or abdomen for fear of wounding important structures. The charts obtained by the profondometer give all the data necessary for the operation; but the harpoon, if

it can be employed, facilitates the rapidity and convenience of the approach to the projectile.

The control measurements made at the time of operation indicated that the error in the profondometer method was rarely more than one or two millimetres, and in the majority of cases was absolutely accurate.

The use of the Sutton localizer at the point of incision selected in the cross-section charts obtained by the profondometer gave a rapid and convenient guide during the period of the operation. If the Sutton method is used alone it is not always easy to select the proper incision from a surgical stand-point, owing to the fact that the exact depth of the fragment is unknown. We found, therefore, that the best results were obtained where the two methods were used in combination. The following series of cases will emphasize this point. The cross-section

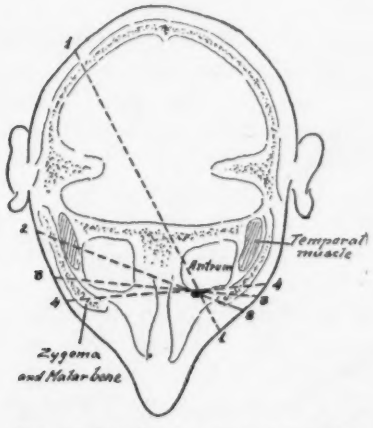


FIG. 8.—Localization chart of Case IV.

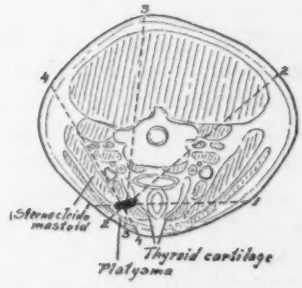


FIG. 9.—Localization chart of Case V.

charts are reductions from those that were obtained at the time the localization was made, and are reduced and made somewhat neater by the artist in copying them. They are arranged in series from the head to the feet to show the adaptability of the method to all regions of the body.

CASE IV.—Admitted November 3 from the Dépôt at Sens. Same patient as Case XVIII.

Wounded July 14 in the Argonne, by shell explosion in the face and leg. On the left cheek over the canine fossa, just below the malar bone about midway between the eye and angle of the mouth, is a healed penetrating wound. Cicatrix is not tender. There is no pain or disturbance. Localization by the profondometer shows (Fig. 8) a small shell fragment in the anterior wall of the left

antrum. Inasmuch as there was no definite indication for operation, this fragment was not removed, and is described to show the ease with which the profondometer can be used in parts of the body with an extremely complex configuration like that of the head and face.

CASE V.—Admitted November 16 from the Dépôt in Sens. Wounded July 15 in the Argonne. Healed wound of entrance just above inner third of left clavicle. An irregularity can be felt on the right side of the thyroid cartilage. It is slightly tender. There is slight pain on deglutition. The radiograph and fluoroscopic examination show a foreign body at the level of the sixth cervical vertebra just to one side of the thyroid cartilage. This is movable, rises with deglutition, and is tender on pressure. With the profondometer the projectile is (Fig. 9) found to lie near the thyroid cartilage and underneath the anterior border of the sternocleidomastoid muscle.

Operation (November 20).—Under local anæsthesia. The projectile proved to be the core of a German ball which had slipped its jacket, probably a ricochet shot. It passed upward from the wound of entrance and partly through the anterior portion of the thyroid cartilage without perforating the larynx. The thyroid cartilage was somewhat deformed. The scar tissue dissected off and the wound closed without drainage.

November 27: The stitches were removed. Wound healed ***per primam.***

CASE VI.—Admitted September 29, 1915. Wounded September 27 at Beauséjour. Penetrating wound at the back of the neck to the right side of the midline about 7 cm. below the occipital protuberance. Patient complains that he cannot move the fingers or the wrist on the right side, has a definite ptosis on the right side, and a contracted pupil. The tongue is protruded to the right, indicating a paralysis of the hypoglossal nerve. The motions of the arm returned a few days after the injury. There is a residual paralysis of the supra- and infraspinatus, which gives the reaction of degeneration. There is no pulsating tumor over the carotid; no bruit; pressure on this side of the neck and over the brachial plexus is very painful. X-ray (Fig. 10) shows a deformed ball at the level of the sixth cervical vertebra at the right side. To our astonishment another ball was found on the left side of the neck just above the clavicle. This was not deformed. On inquiry, the patient stated that he was not wounded before, but a careful examination showed a well-healed small cicatrix near the inner canthus of the right eye at the side of the nose. The patient then explained that he was wounded December 20 of the previous year, and that the ball traversed the hard palate and passed out

of the mouth without injuring the mandible and came to rest on the left side of the neck just beneath the skin, where it could be easily felt. Patient had withheld this information as a joke.

October 11: Localized (Fig. 11) with the profondometer and the ball found lying just to the right of the trachea and œsophagus in the position of the carotid artery. The ball underneath the skin was not localized.

Operation.—Vertical incision along the sternocleidomastoid. Internal jugular vein and common carotid densely adherent to surrounding muscles. The ball was found lying in the common carotid artery, which was thrombosed above and below it. The point also projected a short distance into the jugular vein. As

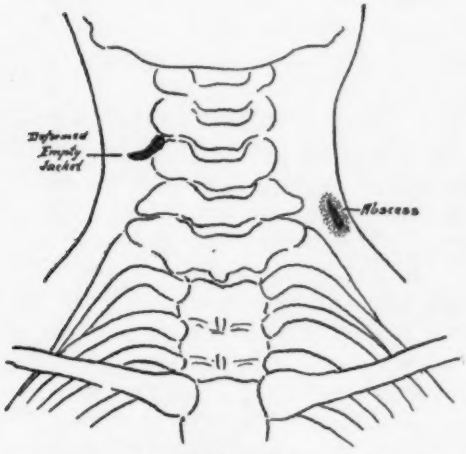


FIG. 10.—X-ray tracing of Case VI (antero-posterior view).

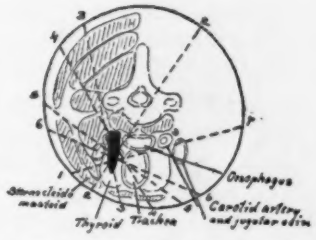


FIG. 11.—Localization chart of Case VI.

the ball was removed there was a sharp hemorrhage from the artery and vein which were doubly ligated above and below the site of the injury. As the projectile was removed it was found to be the deformed jacket of a German ball which had slipped its core, probably a ricochet shot or a machine-gun ball where the heat of the barrel had melted the core. This gave rise to an arteriovenous aneurism, which was occluded by the ball itself with the production of a thrombus in the carotid artery.

The patient did not recover consciousness after the operation, and gave signs of a right-sided cerebral embolism. Probably during the manipulations necessary for the placing of the ligatures about the adherent vessels a portion of the thrombus was dislodged. The patient died two days later without recovering consciousness.

The ball on the opposite side of the neck was surrounded by a

small abscess. This indicates a condition which is not infrequently found where an infected projectile is encapsulated from the surrounding tissues and forms a persisting focus of suppuration.

CASE VII.—Admitted August 20 from the Dépôt at Sens. Wounded April 5, at Bois Le Prêtre. Penetrating wound of the right scapula by shell explosion.

Stayed in hospital three months. Wound suppurated and closed after ten weeks. Since then he has had pains almost constantly in the region of the shoulder. Has noticed since the injury that the angle of the right shoulder drops a little. Had at the time of the injury no pain in the chest and no hæmoptysis.

Surgical Conditions.—There is a puckered scar, 4 cm. long and 2 cm. wide, just over the spine of the scapula on the right side; the latter feels rough and was fractured at the time of injury. Between this point and the mid-clavicular region the tissues are somewhat tender to pressure. Abduction of right shoulder slightly limited and somewhat painful. No paralysis of the muscles of the arm or shoulder. Foreign body not felt.

Physical examination is negative except for impaired resonance at the right apex, where there is distinct bronchovesicular breathing both in front and behind, and subcrepitant râles are heard on both inspiration and expiration. The X-ray shows a distinct shadow at the apex. The patient has little or no sputum. Occasional night sweats. There is apparently no connection between this lesion of the apex and the patient's injury; coincidence purely accidental. The X-ray shows an irregular fragment of shell 7 cm. from the end of the clavicle and situated somewhere behind it. With the profondometer the fragment was determined to be at a depth of 5 cm. from the skin in front and 6 cm. from the wound of entrance behind. The fragment thus lay immediately behind and adjacent to the brachial plexus and the subclavian vessels, with the bony barriers of the clavicle and the scapula between the points of localization on the skin and the foreign body, as is shown in the cross-section chart in Fig. 12. As the only operative approach could be obtained from the supraclavicular region, it was necessary to devise a means to obtain a localization from above. This problem I solved in the following way: A piece of lead like that of which the profondometer is made was shaped over the shoulder with the skin points of diagonal number 2 as a guide. These points were marked on this band of lead. Diagonal number 2 was then projected at one side of the cross-section chart and the lead band so placed that the marks of diagonal 2 correspond to the projected lines. Thus a vertical section of the shoulder was obtained from which measurements could be made to the shell fragment. Selecting the anterior margin of the trapezius as the best point for the incision,

the shell fragment was found to be 5 cm. downward and forward from this point. The method by which this part of the localization was made is shown in Fig. 13 and the result in a vertical plane is indicated at one side of the cross-section chart in Fig. 12.

Operation (August 25).—The harpoon was inserted with the aid of the Sutton cannula and the shell fragment removed in a few minutes with novocaine anæsthesia. It was situated just behind the axillary artery and brachial plexus.

September 3: Wound healed *per primam.*

Comment.—The interest in this case centres in the fact that no other method of localization could give the necessary data for extraction,

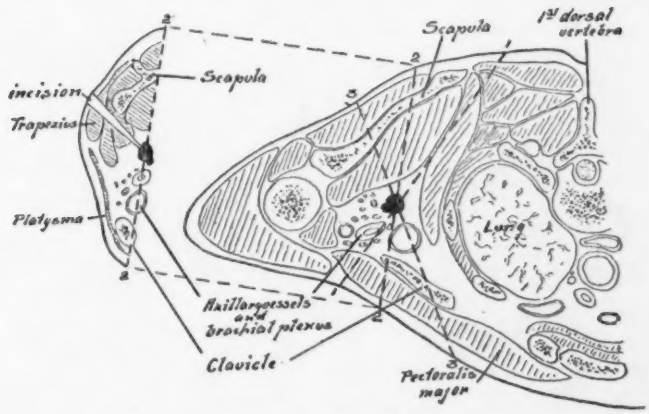


FIG. 12.—Localization chart of Case VII.

owing to the position of the shell fragment behind the bony shoulder girdle. The situation of the shell fragment with reference to the brachial plexus and the axillary vessels would have rendered the Sutton localizer a dangerous procedure without the previous use of the profondometer. It was not until I hit upon the plan of using an extra band of malleable metal to obtain the localizing points for the shoulder at right angles to the horizontal plane of the foreign body that the position of the shell fragment could be determined with reference to the possible operative approach.

CASE VIII.—This patient was sent from the hospital at Joiny for localization. He had been wounded in the neighborhood of the left elbow by the explosion of a shell fragment some months before. Wound of entrance is well healed and under the fluoroscope the fragment was found to lie just in front of the external condyle. The position of the shell fragment is shown in the group

of extensor muscles close to the humerus where it can be easily extracted without damage to either nerves or blood-vessels. The cross-section chart, showing the availability of the profondometer method for fragments in the upper extremity, is shown in Fig. 14.

CASE IX.—Admitted October 9. Sent by the hospital at Auxerre, for localization and extraction of a ball near the upper part of the spinal column.

The patient was wounded September 25, by a French ball. The wound of entrance was situated in the left shoulder just below the acromion process. There is an incomplete fracture of the head of the humerus, a comminuted fracture of the scapula, as

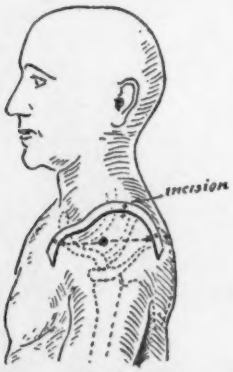


FIG. 13.—Diagram to show the use of a metallic band to obtain measurements and a vertical section over the shoulder at right angles to the original horizontal localization. The result is shown at the left of Fig. 12.

FIG. 14.—Localization chart of Case VIII.

well as a fracture of the angles of the first and second ribs. Pus and gas bubbles can be expressed from the gaping wound of entrance on the shoulder. The patient is very septic.

There is an incomplete paraplegia, but right leg can be moved slightly. The left is completely paralyzed. There is a loss of control of the vesical sphincter and a zone of hyperæsthesia extending over the third, fourth, and fifth interspaces. Below the fifth interspace there is paræsthesia, but not definite anæsthesia. Diagnoses of fracture of the vertebræ and compression myelitis were made. The X-ray shows the shadow of a French ball lying just to the left of the spinous processes of the first and second dorsal vertebræ. The X-ray also shows the fractured humerus, ribs and scapula. The localization of this case was difficult, owing to the paraplegia, and the result is shown in Fig. 15, where the ball was found lying just adjacent to the laminæ of the second dorsal vertebra embedded in the erector spinæ muscles.

Operation (October 9).—Local anæsthesia. An incision 20 cm. long was made with its centre between the first and second dorsal vertebræ. The erector spinæ muscles were separated from the spines on the left side and the ball found exactly at the point of localization. The vertebræ were fractured just at the junction of the laminæ and transverse processes. A laminectomy of the first and second dorsal vertebræ was performed so as to relieve the pressure. The dura was not opened, owing to the probability of the ball being infected. Wound closed without drainage and a culture made immediately from the ball. The next morning this was found to be positive for both streptococcus and gas bacillus, so that the wound was immediately opened and freely drained. Patient continued to run a septic temperature and was in extremely

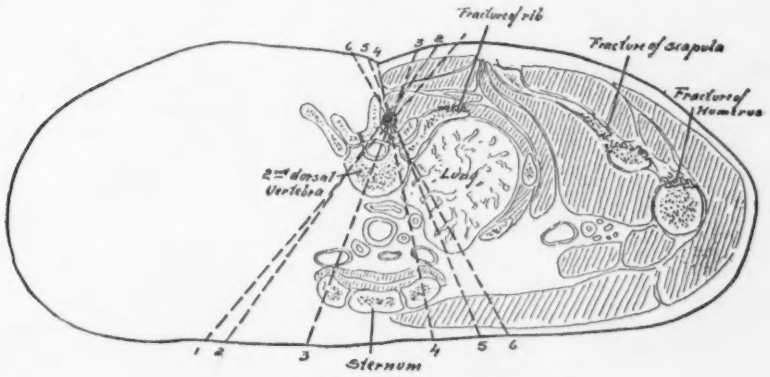


FIG. 15.—Localization chart of Case IX.

poor condition. On November 1 the entire tract of the ball was opened under local anæsthesia and twenty or thirty small fragments of bone removed, which came from the scapula and the upper end of the humerus. Shoulder-joint was apparently free. Up to the time I left the Hospital on November 24 the patient still showed signs of sepsis and only a slight improvement in the paralysis.

CASE X.—Admitted May 14. Wounded by shrapnel at Arras, May 11. Wound of entrance is on the left side of the mandible about 5 cm. from the symphysis. The X-ray shows a ball behind the left sternoclavicular articulation.

He had been operated upon unsuccessfully May 14, the incision being made on the left side of the neck behind the sternocleidomastoid. Ball was not found. Patient showed on neurological examination no nervous lesions, but complained of severe pain on moving the head and left arm. The arm atrophic from disuse.

Localization with the profondometer (Fig. 16) showed that the

shrapnel ball was lying in the superior mediastinum against the body of the second dorsal vertebra just to the left of the œsophagus. Pain is probably due to interference with the movements of the vertebræ during attempts to move the left arm or the head.

Operation (August 5).—Low Kocher incision just above the sternoclavicular articulation, the sternocleidomastoid pushed to the left and the incision carried by blunt dissection down to the carotid vessels. These were retracted to the left, the thyroid gland and trachea to the right. The inferior thyroid artery was divided between ligatures which afforded access to the superior mediastinum and vertebral column. A finger was passed down and the shrapnel ball could be felt lying against the body of the second dorsal vertebra. This was readily removed and the wound closed

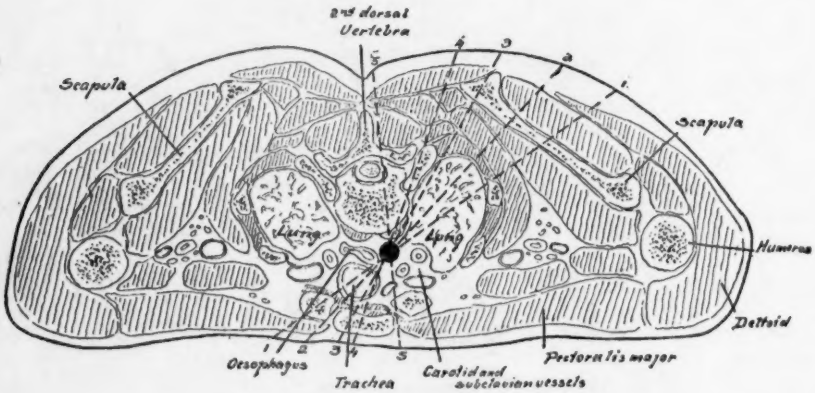


FIG. 16.—Localization chart of Case X.

without drainage. During the operation the pulsations of the arch of the aorta could be easily felt.

August 13: Stitches removed. Wound healed *per primam.*

August 30: Patient started on mechanotherapy. Motions of the arm improving. Pain has disappeared.

September 20: Patient evacuated. Use of arm practically normal.

CASE XI.—Admitted September 11 from the Dépôt at Sens. Multiple wounds by grenade explosion a month before. Wound of the head and right hand, right arm and right thorax at the level of the eighth rib in the posterior axillary line. The wounds on the head, arm, and hand were immaterial. Over the eighth rib there was a suppurating wound together with a definite intercostal neuralgia along the course of the eighth intercostal nerve. Under the fluoroscope a shell fragment was seen on the right side, which moved on in an expiration with the same amplitude as the

diaphragm. This was thought to be in the lung and, consequently, no attempt was made to find it.

Operation (September 15).—The sinus was enlarged where a fractured rib was found with the callus pressing upon the intercostal nerve. This was liberated and the wound drained.

October 9: All wounds healed. At this time the localization was done with the result shown in Fig. 17. The shell fragment, instead of being in the lung as we had supposed, was situated in the latissimus dorsi muscle. This revealed the interesting fact that this muscle apparently moves on in an expiration with the same amplitude as the diaphragm. Shell fragment extracted with local anæsthesia.

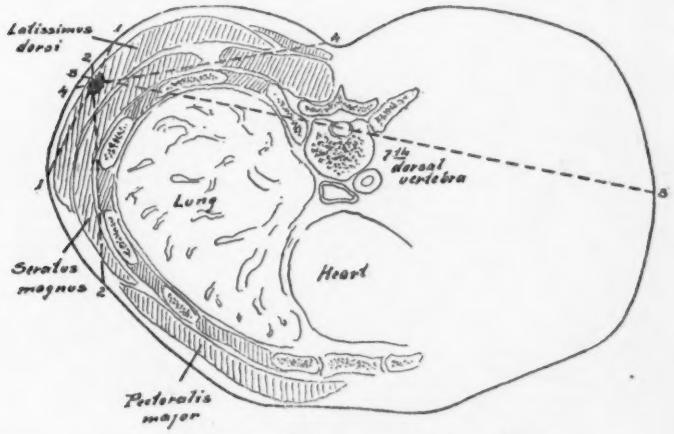


FIG. 17.—Localization chart of Case XI.

CASE XII.—Admitted August 31, from the Dépôt at Sens, with the diagnosis of a ball in the lungs. Wounded March 1 at Bois le Prêtre, in the left side of the chest, by a ball. Immediately after the injury the patient began to expectorate blood in considerable quantities which was accompanied by violent coughing and great respiratory distress. This condition continued for about two weeks and gradually cleared up. Has no cough at present, no pain or dyspnœa.

Examination shows a healed scar 1 cm. in diameter in the left anterior axillary line at the level of the sixth rib. The physical examination of the chest is negative except that the percussion note is somewhat impaired and the breath sounds over the left lower front axilla and base are somewhat distant. Tactile fremitus over this region slightly diminished.

Localization.—Instead of the ball lying in the lung as we expected, the chart (Fig. 18) shows that it is lying in the right

ventricle of the heart immediately behind the sternum, 5½ cm. from the skin. Inasmuch as the patient had no symptoms whatever, an operation for extraction was contra-indicated.

This case shows one of the remarkable instances of the toleration of the myocardium for a foreign body. The ball had apparently traversed the lung and come to rest in the muscle of the right ventricle, where it healed without symptoms. Heart symptoms, if any existed after the injury, were apparently not recognized, or were masked by the hæmopneumothorax that probably existed at the time his wound was received. Of this injury, no signs remained except a thickened pleura.

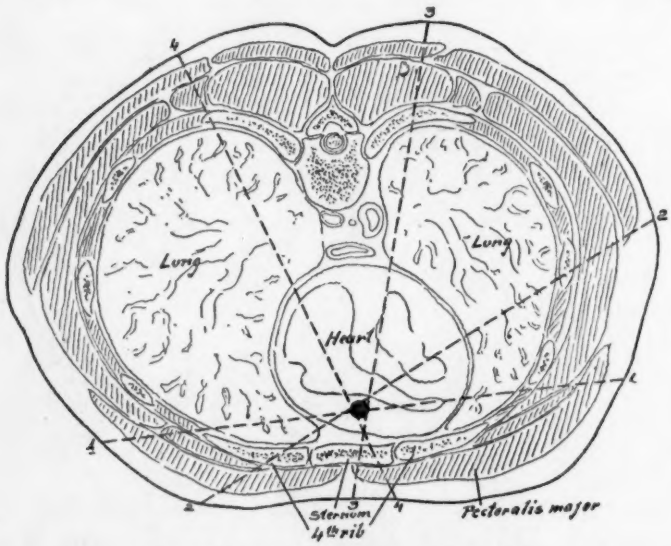


FIG. 18.—Localization chart of Case XII.

CASE XIII.—Admitted September 11. Wounded at Beauséjour on August 22, by ball. The patient shows a wound of entrance over the ninth rib in the right posterior axillary line, from which there is a slight serous discharge. Lungs clear on both auscultation and percussion. The abdomen is soft. There is no general rigidity. There had been no history of hæmoptysis, hæmatemesis, melæna, or peritonitis. There is a point of tenderness over the left linea semilunaris about 3 cm. above the umbilicus. No mass, however, is felt in this region.

Localization is shown in Fig. 19 where the ball is shown about 5 cm. below the level of the skin. It will be noticed that the intersecting lines of the localization vary much more than in any of the previous cases. This is due to the mobility of the ball which moves both on respiration and on changes in the posture of the

patient. A study of this chart reveals that the diagonals do not intersect at one nodal point as is the case in the other localizations, but a more or less quadrilateral space is formed by the diagonals. This is due to the mobility of the ball with the changes in posture of the patient, localizing the projectile inside of this space, the limits of which mark the extent of its mobility.

Operation (September 30).—Left rectus incision. The ball was found embedded among a group of lymph-glands just at the root of the mesentery of the small intestine (Fig. 20), slightly to the left of the aorta. As the cyst wall was opened a small amount of turbid fluid escaped. The ball was easily extracted. Small

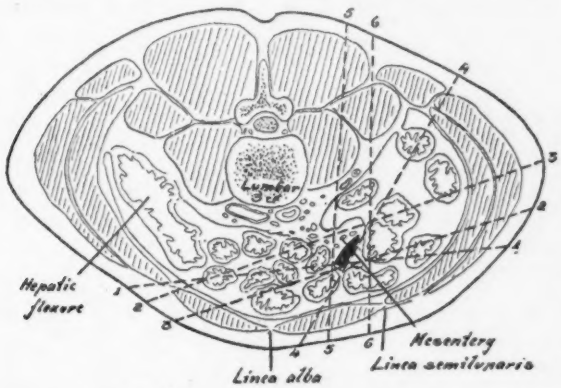


FIG. 19.—Localization chart of Case XIII.

cigarette drain placed to the opening in the cyst until a culture could be made of the ball.

October 1: Culture negative. Cigarette drain removed.

October 9: Wound healed *per primam.*

Comment.—This case is interesting because the ball apparently traversed the liver, the great vessels, and came to rest in the mesentery of the small intestine immediately adjacent to the aorta without perforating any of the hollow viscera.

Localization in this case was interesting because the movements of the projectile in the abdomen are shown by the intersecting lines. In an instance like this, the projectile lies in the space formed by the limiting diagonals.

It is, of course, obvious that in abdominal wounds the trochar method of localization could not be employed, owing to both the impossibility of anæsthetizing the abdominal cavity and the danger of perforating the intestines. The profondometer is the only method which could provide accurate localizing data in a case of this description.

Case XIV.—Admitted August 17 from Hospital at Melun. Wounded in the right buttock, September 16, by shell explosion, at Rheims.

Patient has had three operations in other hospitals, but shell fragment has not been found. On the right buttock just below the crest of the ilium there is a wound of entrance with persistent suppuration. Scars of three other operations are seen; two of these above the crest of the ilium are still suppurating. When the patient contracts his abdominal muscles considerable pus is forced from the wound of entrance on the dorsum of the ilium. At the lower right quadrant there is distinct tenderness, and a deep mass is felt. Pressure of this area causes pus to flow from the sinus.

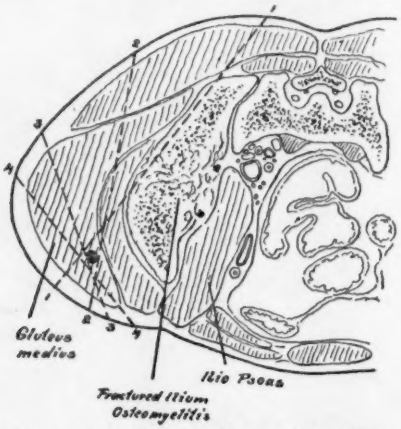


Fig. 21.—Localization chart of Case XIV.

An X-ray examination shows an osteomyelitis of the ilium with an intrapelvic abscess beneath the iliopsoas muscle. There are two very small shell fragments in the intrapelvic abscess and a larger fragment in the gluteal muscles. The sinus was enlarged and a drain inserted.

October 17: With improved drainage the osteomyelitis has subsided and the sinuses have closed. Localization (Fig. 21) shows a large shell fragment in the anterior portion of the gluteus medius, which is distinctly painful on pressure. This is situated 6 cm. below the anterosuperior spine of the ilium and 2½ cm. from the skin. A harpoon was inserted by the Sutton cannula and the shell fragment removed with local anæsthesia. No attempt was made to remove the two minute fragments of shell in the pelvis.

Case XV.—Admitted August 23 from the Dépôt at Sens. Wounded at Souchez, June 21, by ball. Well-healed wound of entrance in the right buttock about 5 cm. below and somewhat to the right of the coccyx. No tenderness of the cicatrix. Patient

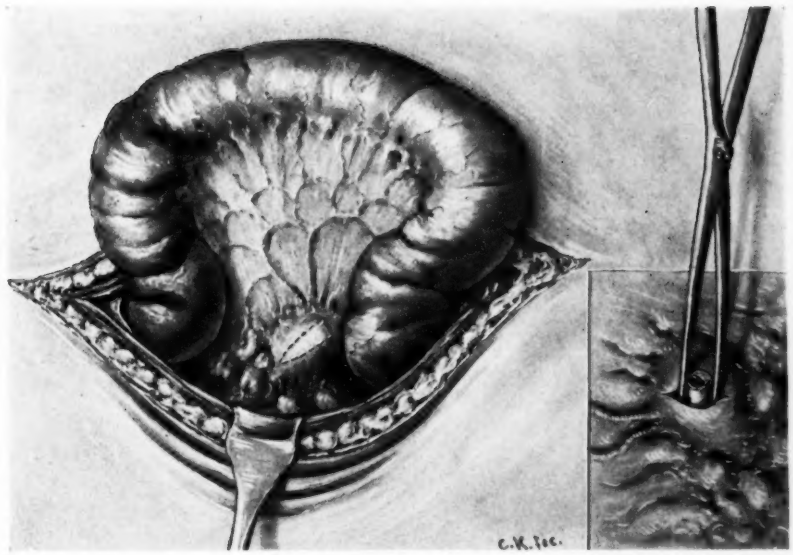


FIG. 20.—Sketch showing a German ball encysted at the root of the mesentery, permitting the mobility found in Fig. 19.

complains of pain, while marching, near the hip-joint. This is local and does not radiate along the sciatic nerve. The X-ray shows a German ball situated apparently near the head of the femur in the anteroposterior view. Localization (Fig. 22) shows that the ball is situated in the gluteus maximus muscle about 5 cm. behind the greater tuberosity of the femur and 4 cm. from the surface of the skin. Harpoon introduced. Extraction with local anæsthesia.

September 7: Sutures removed. Wound healed *per primam.*

CASE XVI.—Admitted September 29. Wounded September 27 at Beauséjour by shell explosion. The wound of entrance is in the right pudendal fold. The fragment has apparently passed

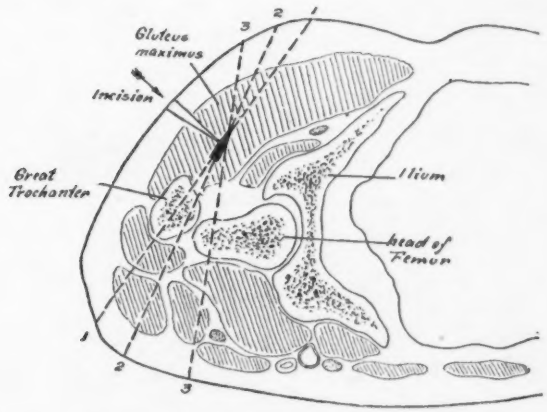


FIG. 22.—Localization chart of Case XV.

downward and forward in the adductor region. Wound healing without reaction. Sterile dressing.

The X-ray shows a shell fragment in the adductor region at the level of the lower end of Scarpa's triangle, internal to the femur.

October 15: Wound is entirely healed. Localization (Fig. 23) shows a large fragment arrested by the adductor membrane immediately behind and internal to the femoral vessels. This is an extremely frequent position for balls or shell fragments to come to rest. Apparently the tough intermuscular septum forms an elastic curtain which is extremely resistant and tends to stop further progress of the projectile unless the velocity is great. We have had at least six or eight similar cases with wounds of entrance in various parts of the thigh.

To avoid the femoral vessels and the larger perforating branches, incision was planned through the adductor muscles. A

harpoon was inserted by means of the Sutton cannula and the fragment removed with local anæsthesia.

October 29: Patient completely healed and out of bed.

CASE XVII.—Admitted September 11. Wounded at Beauséjour, September 8, by shell explosion. Penetrating wound 1 cm. in diameter, situated 3 cm. above the upper border of the patella. Marked effusion into the knee-joint. Patella floats. Fixation dressing.

November 2: Wound is entirely healed. X-ray shows two shell fragments at the same level, one of which has penetrated the femur, making a small depressed fracture. The localization (Fig. 24) showed the two shell fragments at the same level, one 4 cm. from the skin, and the other just inside the femoral shaft. Selecting the diagonal 1, the harpoon was placed by means of the Sutton cannula so that it passed and touched the more superficial

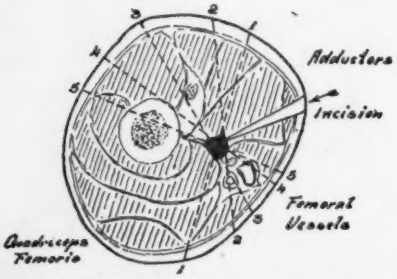


FIG. 23.—Localization chart of Case XVI.

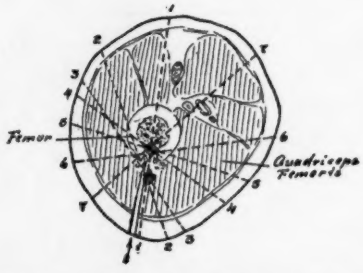


FIG. 24.—Localization chart of Case XVII.

fragment and came to rest upon the deeper fragment. This diagonal was chosen because it was the only one which passed through both fragments.

Operation (November 2).—Local anæsthesia. Incision 12 cm. long. Deepened to the level of the superficial fragment which was then extracted. The harpoon was then followed and the deeper fragment found buried in a crater of bone formed by the depressed fracture of the femur. The periosteum was infiltrated with novocaine and the crater chiselled out, so that the fragment could be removed. Wound closed without drainage.

November 10: Stitches removed. Wound healed *per primam.*

November 17: Patient walking without difficulty. Effusion of the knee-joint entirely absorbed.

Comment.—This is the first case in which two fragments were localized at the same level. An inspection of the chart shows how accurately the two nodal points where the diagonals intersect give the localization of the two fragments. The selection of the incision here

was due to the fact that the diagonal 1 gave the most convenient approach to facilitate the removal of both projectiles through the same incision.

CASE XVIII.—The same patient as Case IV. Besides the wound in the face, the patient had eight small wounds on the inner and lower aspect of the thigh. A portion of these wounds were through-and-through, and two were penetrating. The patient remained in hospital two months. Two wounds healed after suppurating for about six weeks. Patient now complains of stiffness of the flexor muscles of the leg. The X-ray shows two shell fragments, one apparently on the inner anterior aspect of the thigh and the other on the posterior aspect near the skin. These are at the same level about 12 cm. above the patella. Localization (Fig. 25) shows that one fragment lies in the vastus internus

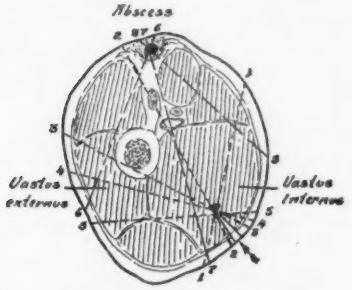


FIG. 25.—Localization chart of Case XVIII.

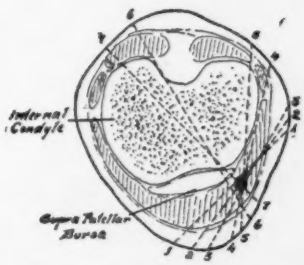


FIG. 26.—Localization chart of Case XIX.

muscle about 2 cm. from the skin. A second fragment is located about 1 cm. from the skin, between the hamstring muscles, and is surrounded by a definite area of induration, like a small encapsulating abscess. Harpoon inserted for the deeper fragment in the vastus internus. This was extracted by its aid. The posterior more superficial fragment was found to be the nucleus of a small encapsulating abscess. Both wounds drained. Both fragments infected.

November 20: Wounds granulating nicely. Both practically healed.

CASE XIX.—Admitted September 29. Wounded September 27, in Champagne.

There is a small gutter wound over the external aspect of the right knee at the level of the patella. Wound is superficial. Joint is not involved. There is a penetrating wound on the external aspect of the left thigh 20 cm. above the patella, with marked swelling about the knee and marked effusion in the joint. Wound of entrance healed without reaction.

The X-ray shows a German ball lying just above the patella close to the external condyle, about 9 cm. above the joint surface. Localization (Fig. 26) shows that the ball lies with its long axis parallel to the long axis of the femur, situated 2 cm. from the skin, and lies in the vastus externus muscle close to the suprapatellar bursa. Ball removed with diagonal 7 as a guide, without the aid of the harpoon. This was omitted owing to the proximity of the joint.

November 14: Stitches removed. Wound healed *per primam.*

Case XX.—Admitted September 11. Wounded September 9, at Mensil les Hurlus, by aeroplane bomb.

Multiple wounds of the right leg and foot which are of no consequence. Simple fracture of the middle of the right humerus. Lacerated wound over the inner aspect of the left knee, 7 cm. long, with the granulating necrotic base. Marked swelling about the knee-joint and distinct effusion into the joint cavity. The arthritis is probably traumatic. No evidence of infection.

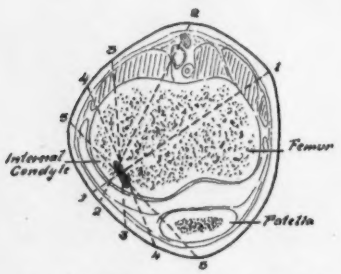


Fig. 27.—Localization chart of Case XX.

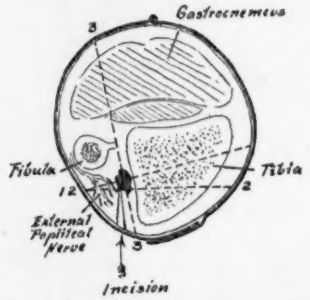


Fig. 28.—Localization chart of Case XXI.

December 4: Fracture of the humerus is united. All wounds are healed. No functional disturbance from the wound of the knee. Localization (Fig. 27) shows an elongated shell fragment embedded in the internal condyle of the knee just behind the reflection of the capsule.

Owing to the lack of any definite indications for extraction and the inaccessible position of this fragment with reference to the knee-joint, this fragment was not removed.

Case XXI.—Admitted August 13, 1915. Wounded September 6, 1914, at Noyons, by shell explosion. Penetrating wound on the external anterior aspect of the right leg at the junction of the middle and upper thirds. The wound healed after suppurating for four weeks. Since then the patient has had pain in the outer aspect of the leg, particularly when marching.

The X-ray shows a shell fragment just below the head of the fibula in the peroneal muscles. The fragment evidently lies close to the external popliteal nerve.

August 30: Localization (Fig. 28) shows the fragment lies in the ankle between the tibia and fibula, close to the internal aspect of the tibia. Incision was selected parallel to the internal aspect of the tibia to avoid the possibility of injuring the external popliteal nerve. This approach rendered easy access to the fragment, which was removed without difficulty with the aid of local anæsthesia.

September 10: Stitches removed. Wound healed *per primam.*

September 25: Patient walking without pain. Apparently the shell fragment pressing upon filaments of the peroneal nerve gave rise to traumatic neuritis.

Case XXII.—Admitted August 21 from the Dépôt at Sens. Wounded by shell explosion, June 7, near Arras. Wound healed within one month. On July 8 an effort at extraction was made, but the shell fragment was not found. Since then the ankle has remained swollen, and has been painful, particularly when walking. The patient shows a scar 2 cm. in diameter on the inner side of the left tendo Achillis. Immediately behind and somewhat below

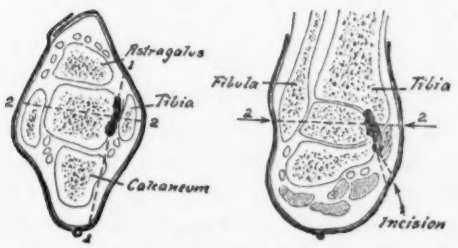


Fig. 29.—Localization chart of Case XXII.

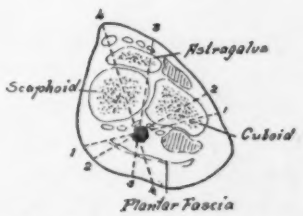


Fig. 30.—Localization chart of Case XXIII.

the internal malleolus is a well-healed scar of operation. The region of the internal malleolus is slightly swollen and tender. There is some voluntary limitation of motion from pain; inversion and eversion of the foot are especially painful.

The X-ray shows a large shell fragment lying partly in the joint between the internal malleolus and the astragalus. Localization (Fig. 29) shows that the shell fragment lies between the astragalus and internal malleolus, in a position where direct operation is impossible owing to the bony barriers. In consequence, the same procedure that was used in the shoulder case was employed, and a second observation made with diagonal 2 as a base extending underneath the foot, and a point of incision selected which extended upward and inward so that the shell fragment could be withdrawn from its position between the two bones. This procedure is shown in the localization chart in this case.

September 3: Stitches removed. Wound healed *per primam.*

September 20: Patient walks practically without difficulty.
September 25: Evacuated.

Case XXIII.—Admitted August 12 from the Dépôt at Sens. Wounded near Arras, July 7, by shell explosion. Well-healed wound of entrance on the inner aspect of right foot. Since then there has been considerable difficulty and pain in marching, so that the patient is incapacitated from military service.

The X-ray shows a shell fragment lying on the plantar aspect of the foot just beneath the scaphoid and cuboid bones.

September 1: Localization (Fig. 30) shows that the shell fragment lies beneath the plantar fascia in close proximity to the flexor longus digitorum tendons. Incision is made in the plantar aspect of the foot along the direction of diagonal 2, and after wound had been deepened to 3 cm.—the depth indicated on the localization chart—the fragment was immediately felt after the application of the vibrating magnet. This was extracted without difficulty.

September 10: Stitches removed. Wound healed *per primam.*
September 20: Evacuated. Patient walks without difficulty.

This series of cases has been selected from those operated upon to demonstrate the development of the localizing methods, and particularly to emphasize the adaptability of the profondometer and harpoon methods to the various regions of the body. It will be obvious from a review of this series of cases that no one localizing method is adapted to the extraction of projectiles in all cases. The methods must be suited to the requirements of the individual case. We may conclude in general, however, that up to the present time the vibrating magnet and the Sutton cannula with the harpoon are perhaps best adapted for immediate operation on cases fresh from the front, although their limitations must be constantly borne in mind. The profondometer is by all odds the most useful and the most general in its application, and provides localization data upon which practically any extraction can be made. In cases where the foreign bodies lie in the extremities or in the soft parts, the harpoon guide inserted by the Sutton cannula is of great service in providing the operator with a conductor which will lead him directly and rapidly to the foreign body. This, however, should not be employed when the projectiles lie near important nerves or vessels, even in the extremities. It may be asserted that in most cases the use of these localizing methods makes the extraction of the foreign body a minor operation, inasmuch as 80 per cent. of them can be performed by local anæsthesia.

The process of localization is not a time-consuming one, inasmuch

as the localizing charts can usually be made in a half to three-quarters of an hour. In all grave cases, like those of the chest and abdomen, the localizations were repeated after an interval of several days had elapsed, and the charts obtained from the two localizations made on transparent paper were superimposed. In these instances, localizations made without any reference to each other never showed a variation of more than one or two millimetres. These methods do not require complicated apparatus, and may be employed in any hospital which possesses a good X-ray machine and a good fluoroscope. The profondometer can be constructed by anyone with a little mechanical ability and costs but a few cents, while the Sutton cannula and the harpoon can be constructed by any instrument maker.

METHODS OF HANDLING INJURIES ON TRANSPORTATION SYSTEMS AND WOUND TREATMENT*

By Kenneth A. J. Mackenzie, M.D.
of Portland, Oregon

Crossing the Atlantic five years ago in a great ocean liner, four days out at sea, the purser's assistant was seized with an acute attack of appendicitis. Consultations were held with the ship's surgeon and the captain and officers, which culminated in the decree that an operation be performed at sea. A survey made quickly revealed that no provision existed for such an operation—not even the necessary instruments. Under orders of the surgeons, however, the engineers improvised quickly the necessary arrangements, which proved in the end to be effective. The operation was performed at midnight under difficulties. The following afternoon the arrival of the ship at Fishguard enabled the patient to be transferred to a marine hospital in Liverpool, where he recovered.

Four thousand people occupied the ship for five days, or the equivalent of twenty thousand for one day, and yet no provision existed for the care of emergencies that might under the law of average be expected to develop at any time in such a large concourse of people.

Many questions arise in relation to this subject: What provisions are made by transportation companies to meet the countless emergencies of the day which are the product of the feverish activities of modern industrial life? What is being done to prevent the appalling sacrifice of human life? What are the measures used by the common carrier for the prevention of the crippling and maiming of its workmen and patrons? How are injuries and wounds treated in the field? What are the elements of first aid prescribed and practised? Do they measure up to the standards of the army and navy and those used in civil life?

The principle implied in the shibboleth "Safety First" looms very largely in all social activities organized for the prevention of the great vital and economic waste which is the concomitant of forces allowed to run riot and breed emergencies in an endless chain.

When Josiah Strong, whose death has been recently announced, first initiated the "Safety First" movement, he little dreamt it would

* Read before the American Surgical Association, May 10, 1916.

attain such momentum as to become within a short span of two or three years a world-wide movement destined to have great influence upon the welfare of the human family. The American Institute of Social Service was organized by him in 1898, and within two years was extended over the United Kingdom, and at the beginning of the great world war at least five of the warring nations formed institutes along the line of his original organization.

While much may be written of the humanitarian and economic sides of the question of "Safety First," it is probably in the latter that it has found its greatest development. Conditions vary in different countries, and what is being done for the prevention of emergencies in the crowded centres of the East will not find an exact counterpart in the more sparsely populated communities of the West. In the East, emergencies are readily met because they are accessible to the community with its organized institutions. In the West, however, with its great stretches and isolated communities a more complex organization becomes necessary to meet emergencies as they come.

Railroad companies, more than any other organizations, have to consider acutely both the economic and humanitarian sides of this great movement because the law requires them to transport their patrons in safety, and also to protect their employees from the hazards peculiar to their occupation, and, recognizing the great principle of prevention, they have not been slow to adopt it.

The late E. H. Harriman, who in his short but meteoric career showed the world that he was the greatest builder of railroads, seized every principle of constructive character readily and applied it at once for the elevation and betterment of service. After he had financially rehabilitated the Union Pacific in line with his conservative policy in railroad management, he installed at colossal cost the system of automatic block signals over the entire Union and Southern Pacific Systems.

A survey recently made of the emergency service of a western railroad system, one of the links of the Union Pacific, with which I have had for many years official connection, enables me to present to this august body, which should be the arbiter of such large questions, the methods that are in use at the present time and which, perhaps, may be taken as an index of those that prevail at large.

In the study of ideal methods of treating emergencies or injuries on transportation systems the study of prevention should receive the first consideration. It begins with a highly trained and vigilant executive, and predicates the constant coöperation of operating officials and workmen in an unceasing effort to work with such forethought and

care that no break in good order takes place to cause the emergency. It goes without saying that careless and shiftless methods would breed emergencies just as the converse would prevent them.

A factor of great importance in the prevention of accidents is found to be the systematic study of their causes. Committees of safety meet at least once a month and enter seriously upon the discussion of all accidents that happen in all the departments of the system. The discussion, for example, develops that a number of accidents have happened because of the giving way of grab-irons on freight cars leading to the infliction of serious injuries to the workman. At another time it develops that the workmen in a foundry, in violation of the rules of the service, are working without protecting glasses when sparks are constantly flying. A chain of such accidents is recorded and a system of correction immediately applied. It develops, perhaps, that on a foreign railroad system collisions are taking place with increasing frequency. A State commission proceeds to investigate the cause and finds that it is the result of greatly augmented traffic. Remedial measures are applied but accidents continue. Ultimately the management is forced, in the interest of public welfare, to install the automatic block signal, which is the best factor of prevention of the greater emergencies.

Organization.—The organization of a hospital contemplates first a corps of surgeons who are under the direction of a chief surgeon. There are surgeons in charge of divisions and districts and also specialists. The chief surgeon is stationed at headquarters, and there are surgeons placed at short intervals on the line, so that the whole system is linked up by a chain of service, and they are all governed by established rules and discipline.

Hospitals are of two kinds: the general hospital for the treatment of severe emergencies and sickness and hospitals for primary and ambulatory treatment. The general hospitals are placed in the larger cities and are furnished with every modern appointment. Accommodations are more frequently given in wards, but the private room is available for the more severe emergency and also trained nurses. The X-ray is universally used in fractures and dislocations.

The emergency hospitals recently established on this system have for their special object the giving of prompt service and possess every facility for the immediate relief of all manner of injuries and their effects. They are placed adjacent to shops and round-houses where many employees are concentrated. The appointments are complete, and a system of records is kept by a nurse, who is in attendance during

the working hours and is qualified to give first aid. It is found that such hospitals diminish the incidence of infections in wounds great and small and are invaluable in meeting such emergencies as hemorrhage and shock.

Equipment.—The emergency equipment should include a hospital train or car, stretchers, emergency trunks, emergency handbags, Johnson first-aid cabinets, and stationary surgical cabinets at round-houses and shops. Stretchers are placed at frequent intervals along the line, at even unimportant stations, and on all trains and at the terminals a large number are kept on hand.

The emergency trunks are placed at all division points, and at important stations, where they can readily be moved to the scene of the wreck. At the present time there are fourteen such trunks in use throughout the system. They are intended for large emergencies, and are capable of taking care of fifty or a hundred injured people, and a special trunk, with reserve supplies and comforts, is held in readiness at headquarters. The trunks contain instruments for any surgical operation that may be necessary, a complete assortment of medicines, restoratives, anæsthetics and dressings, together with a variety of splints, including plaster of Paris. (See list of contents appended.) The published time table of the railroad always contains a list of the local surgeons and their addresses and the location of the emergency equipment.

The emergency handbag has proved a most useful utility. It is placed at the disposal of the division and district surgeons at busy points and also on all business cars which are constantly moving over the right of way, and therefore readily in touch with emergencies. When accidents happen they are brought quickly to the scene, and not infrequently a travelling physician or surgeon has found them of great service. They contain dressings and bandages to take care of a dozen or more cases, and instruments to deal with ordinary emergencies and also medicines, restoratives, and anæsthetics. (See list of contents appended.)

A very valuable utility is a stationary surgical cabinet which is placed in shops and round-houses for the immediate treatment of wounds and for the prevention of infections. It is made up of a series of shelves and drawers with facilities for holding basins, and is equipped with standard solutions and first-aid packages for the treatment of injuries.

Emergency hospital rooms are also being installed at terminals and large stations. In the city of Seattle the plan consists of a waiting room

and an operating room containing every appointment for a major operation. It is a model of its kind and is equipped for the storage of emergency supplies.

Rest rooms with trained nurses in charge are maintained in large office buildings for the comfort and care of employees and for the treatment of minor ailments. The popularity and usefulness of this service have been attested many times.

In former times, emergency first-aid packets were placed in suitable receptacles in baggage cars on trains, but it was found impossible to keep them stocked because of the pilfering of their contents. It is now proposed to place the various first-aid packets in stations under the control of the agent who would be authorized to issue them at a nominal cost, say ten cents, to any employee needing them. In theory the fee would be charged not for profit but for the prevention of waste.

Transportation.—The ideal method of transportation would be a train of several cars always in readiness, one for the transportation of the injured, a second for general treatment, including operations, and a third for the accommodation of the staff, nurses, and attendants. The drawback to this method, however, would be that this costly outfit would not be available when needed. The practical method would be a single car converted for immediate use, the most available being a Pullman coach, and perhaps the most effective of all would be to have on each division a converted day coach or even caboose car marked with the red cross always in waiting at division points, having accommodations for five or six cots and a small compartment designed for emergency operations. Such cars should possess at all times complete equipment for immediate mobilization with the general wrecking outfit to the scene of the wreck.

System of Mobilization.—When emergencies happen the news is received by the dispatcher, who in turn notifies the superintendent, whose actions are governed by the character of the emergency. In train wrecks the general wrecking outfit would assemble the equipment *en route;* the dispatcher would summon the nearest division and district surgeons and engage other available surgeons to meet the situation. Every dispatcher should have in mind at all times the location of all the hospital equipment and direct its mobilization by wire.

When single injuries take place it is found that the first passing train furnishes in most cases convenient and timely transportation, and instructions are wired to the point of destination to have an ambulance in waiting. Formerly, when emergencies happened at remote places, a possé of the train crew would have to run to the station, perhaps ten

miles or more, to make notification of the wreck. In these days the telegraphone, which is carried on every train, is used to send the news direct to the nearest dispatcher, who thereupon alone commands the operations. He directs everybody and everything necessary to the scene of wreck.

First Aid in the Field.—Three types of first-aid dressings are proposed: (1) a simple sterile dressing; (2) the hypertonic salt dressing; and (3) a dressing recently devised and which will be described in due course.

The first dressing consists of two pieces of gauze, the larger 40 × 3 inches and the smaller a bandage loosely folded 18 × 1½ inches. These are enclosed in a loose glazed paper cover so placed as to envelop the gauze and enable the dressing to be picked up without soiling when being applied to the wound. This dressing is packed in a small envelope hermetically sealed. The second dressing is larger and contains two pads of gauze, 40 × 3 inches, a triangular bandage, and two safety pins. The triangular bandage is designed for various uses, such as the sling, the tourniquet, and to retain bandages. It is sealed and ready for use in compact cartons. The gauze elements in both these packets may be made a hypertonic salt dressing by immersion in a 5 per cent. solution of sodium chloride and allowing the salt to crystallize in their meshes, thereby making it a sodium chloride gauze. We would recommend first-aid dressings to be made in four sizes: the first and second corresponding to the simple sterile or hypertonic dressing already described for small wounds; the third of gauze of two sizes, one and five yards in length respectively, folded in eight layers four inches wide, and sealed in cartons.

The two larger first-aid packets constituting the third variety are intended for the larger types of wounds. It has been determined many times that wounds become refractory to treatment and develop infections because they have not been sufficiently protected by dressings; a diminutive dressing, however good it may be, cannot be expected to protect a wound that is extensive. It is therefore advised to use dressings that will not only carry therapeutic but also protective and mechanical advantages. In compound fractures and all wounds with large areas the large first-aid gauze dressing will be found of priceless value.

The experience of surgeons in the great war has revealed the merit of certain preparations in wound treatment, and there would seem to be a general consensus as to the value of common salt. It seemingly acts by stimulating the migration of leucocytes and promotes the outflow

of the fluid constituents of the tissues, thus favoring drainage. By combining with it sodium citrate in 0.5 per cent. strength the coagulation of the blood is prevented, thus further favoring the outflow to the surface and serving the principle of drainage.

The third variety of dressing, already alluded to, may also be prepared in four sizes, although the general efficacy of the sterile and hypertonic dressings for small wounds would make any other superfluous. It is necessary for this dressing to have a standard solution, which is made up of the following ingredients; metallic iodine one part, pure liquid green soap, neutral to litmus, ten parts, rectified spirit fifteen parts, and sterile water to make one hundred parts. If the preparation were found unstable because of the alkalinity of the soap, the iodine might be added at the time of use in the strength indicated.

The soap content of this dressing is most effective, acting as it does upon the entire surface with which it is in contact, cleansing and purifying it. Thus its lather emulsifies all the débris not only in the wound but on the skin, and, holding it in suspension and forming a pellicle over the wound's surface, it offers a barrier to infection. When the dressing is removed at the time of the first surgical treatment the gentlest irrigation will suffice to sweep away all the scum that has collected, enabling the surgeon to proceed with the treatment of the wound without the further infliction of trauma. The soap content further has the effect in contact with all foreign matter, blood clots, and infective material in general, of liquefying or cleansing them, favoring their elimination and acting as an emollient and detergent agent. The emulsified product of the wound naturally seeks an outlet in the gauze which abundantly surrounds the wound.

The iodine content of this formula is effectively germicidal and non-irritating, and has a similar effect to the hypertonic solution in promoting phagocytosis.

The alcohol content is useful as a mild antiseptic, and its value is enhanced because of its association in this preparation with the soap and iodine. The soap emulsifying and disintegrating clots and other infecting elements enables the alcohol and iodine to attack with greater effect. The action of this formula is favored by the movement of muscles or broken fragments of bone in transit.

We have not had an opportunity of studying intimately the time factor in relation to infections without the previous use of first-aid dressings. We have, however, observed many times in cases of compound fractures which have not received first-aid service of any effective kind in the field, that after the lapse of from five to eight hours

before the institution of treatment we have successfully overcome the tendency to infection by preparations in common use in our service into which rectified spirit enters very largely as a detergent agent. Other things equal, we would expect, in wounds that had received the elements of infection, exposure having lasted from five to eight hours, that the soap, iodine, and alcohol formula would be a more powerful factor in the control of infections than the hypertonic salt preparation. There would be no fear on our part to treat small wounds five hours after infection with either of the preparations, but the belief is strong that the protective principle would rest in favor of the soap formula.

One of the vital factors in first aid in the larger emergencies with fractures and dislocations is the use of an effective splint adapted to general conditions. For this purpose we have found nothing better than the woven-wire material known as fruit-growers' wire of 6×6 mesh (six of its squares are equal to a linear inch). It is made of galvanized wire, each mesh being soldered together, which makes it very pliable. When additional fixity is needed it can be doubled or trebled in thickness. Its yielding and pliable qualities adapt it to the protection of parts rendered vulnerable by injury. As a substitute, nothing will be found superior to the familiar blanket or pillow splint so generally known, and the first-aid equipment should include a variety of quilted pads to line them. The majority of wounds treated in the field by these methods will be found very often to unite by first intention or to pursue a favorable course in healing by granulation.

The surgeon will very often have to determine at the moment of treatment the procedure that is immediately necessary, and it will be found quite often that in the case of wounds in which the soft parts have been lacerated and deeply contused, or crushed to a pulp, it will be necessary to trim away with scissors and knife all the dead, devitalized tissues, carrying the resection to a degree that the wound at last presents at every point a fresh, ruddy, healthy bleeding surface. So clean may a wound of this kind be made by the removal of all doubtful tissue that a primary skin-grafting operation might even be contemplated. This has been done several times very successfully in our clinics.

It is impossible to lay down any formula for the treatment of infected wounds; one must be governed by the findings in the case. The principle of drainage looms largely in such cases, and must be determined by the surgeon at the time. We have never found any advantage in the use of strong antiseptics, such as carbolic acid and even iodine. Many times after every pocket has been found and suitable

incisions made, we have constantly found that rectified spirit possesses the most salutary effect after being placed in contact thoroughly with all parts of the wound. Drainage with sterile gauze afterward, or gauze impregnated with rectified spirit, has been found constantly to give the best results.

In conclusion, it should be the policy of every railroad company to develop as many skilled men as possible who would be of service in emergencies: conductors, station agents, engineers, and foremen in all departments should receive systematic instruction in classes through a series of lectures and demonstrations, and the system of instruction should be kept up until they have been proved competent by examinations.

The direction of this service and the conduct of its details should be in the hands of a medical officer whose chief function would be to travel constantly over the system giving instruction and guarding the emergency equipment.

CONTENTS OF EMERGENCY TRUNKS

Breakable tube with threaded needle.
Catgut, 1 dozen.
Silkworm-gut, 1 dozen.
Silk, 1 dozen.
Gauze bandages, assorted, 5 pounds.
Muslin bandages, assorted, 2 pounds.
Sublimated gauze, 1-yard cartons, 24.
Plain gauze, 1-yard cartons, 12.
Absorbent cotton, 5 pounds.
Picric acid gauze, 6 boxes, 1 dozen each.
Antiseptic tablets, 1 bottle, 500.
Safety pins, Nos. 1, 2, and 3, 2 dozen each.
Tank package, catgut, 1; silk, 1.
Pyramid pin, 1.
Adhesive plaster, 1-inch, 1 roll; 2-inch, 1 roll; 3-inch, 1 roll.
Yucca palm splint material, Nos. 1, 2, and 3, 1 dozen each.
Porcelain steel basins, white enamel, 3.
Alcohol lamp, 1.
Hypodermic syringe (all metal with four bottles), 1.
Chloroform, 500 gm., 1.
Ether, 500 gm., 1.
Alcohol, 95 per cent., 1 pint.

Turpentine, 8 ounces.
Green soap, 8 ounces.
Esmarch inhaler, 1.
Plaster-of-Paris bandages, 1 dozen, 3-inch.
Oiled silk, 5-yard roll, 1.
Soft rubber catheters, ½ dozen.
Hand brushes, 2.
Glass graduate, 2-ounce, 1.
Brandy, 1 pint.
Carbolic acid solution, 4 ounces.
Compressed towels, 1 dozen.
First-aid packages, 1 dozen.

INSTRUMENT ROLLS CONTAINING

Amputating knife, 1.
Mathieu's needle-holder, 1.
English scalpels, 2.
Straight bone forceps, 2.
Thumb forceps, 1.
Key-hole saw for cutting splints, 1.
Tongue forceps, 1.
Curved scissors, 1.
Grooved director and tie, 1.
Pean's artery forceps, 3.
Bandage shears, 1.
United States Army tourniquet.

CONTENTS OF EMERGENCY HANDBAG

4 packages 1 yard red cross gauze.
2 packages 2 ounces absorbent cotton.
2 packages 1-ounce absorbent lint.
1 package 1-inch × 10-yard adhesive plaster.
4 rolls 3-inch gauze bandage.
4 rolls 2-inch gauze bandage.
3 rolls 1-inch gauze bandage.
1 box picric acid pads.
1 bottle synol soap.
1 tube unguentine.
1 roll, 12 × 14 inches, oiled silk.
2 papers safety pins.

1 bottle antiseptic tablets.
1 needle-case.
1 hypodermic syringe filled.
6 envelopes of sutures with needle.
1 dozen splint wood.
3 3-inch plaster-of-Paris bandages.
1 1¼ Squibb's ether.
1 flask of brandy.
1 case of instruments.
1 case of medicines.
1 pound of boric acid.
1 United States Army tourniquet.

CHRONIC GENERAL INFECTION WITH THE BACILLUS PYOCYANEUS*

By Leonard Freeman, M.D.
of Denver, Colo.

The following paper contains a brief statement of the prominent symptoms of pyocyanic infection, together with the main facts in its pathology, and a somewhat detailed report of an instance of the more unusual chronic form of the disease.

Systemic infection with the bacillus of green pus, which was first scientifically studied in man and animals by Charrin, some thirty years ago, occurs in two forms—the acute and the chronic. The former runs its course in a few days, while the latter may persist for weeks, months or even years. It is a serious disease, often resulting fatally, although recovery occasionally takes place. It is usually observed in infants and young children, although many cases have been reported in adults, and their number will probably increase as familiarity with the symptoms becomes more general. The acute form is by far the more common, the chronic apparently being so rare that only a few cases have been reported.

The acute infection comes on suddenly, with violent gastro-intestinal symptoms. There is purging and vomiting, high fever of the septico-pyæmic type, headache, and pain in the back and limbs, often extremely severe. In a short time a cutaneous eruption appears, mostly upon the trunk and extremities, which is erythematous and even hemorrhagic in character and manifests itself in reddish or bluish macules and papules, and occasionally blisters, pustules or petechiæ. Death in a few days is the usual outcome.

The chronic infection usually begins acutely, although this is not always so. After its acute stage is past there sets in a long course of irregular septic fever, accompanied by chills and sweats, by a more or less marked cutaneous eruption, and by neuralgic pains in the extremities, mainly the legs, which are often followed by paresis and marked atrophy of various muscles. The disease may continue almost indefinitely, leading to great weakness, emaciation, hebetude of mind and generally death.

In both the acute and chronic forms, pleuritic, pulmonary, meningeal

* Read before the American Surgical Association, May 10, 1916.

and nephritic complications are not uncommon, and enlargement of both spleen and liver is quite constant, especially the former. Cirrhosis of the liver and kidneys has been observed in the more chronic cases, as well as perihepatitis and effusion into the various serous cavities, such as the pericardium, pleura, meninges and joints. Icterus may be present, from involvement of the liver.

The leucocyte count is increased but little, if any, and may even be markedly decreased, owing to the presence in the blood of a leucocidin.

Careful pathologic investigation (Fraenkel) seems to show that the bacillus pyocyaneus is not a true blood parasite. In other words, it does not grow within the blood, as do the micro-organisms of a true septicæmia, but merely uses the blood as a means of transportation from one locality to another, so that blood examinations may reveal the germ at intervals only or not at all. In fact, it is much more likely to be found in the bile than in the blood, owing to its predilection for the liver, together with other parenchymatous organs. Wherever it finds lodgement, however, it multiplies rapidly within the walls of the vessels and in their immediate vicinity, thus accounting for the hemorrhagic phenomena and infarcts which so frequently manifest themselves in the skin, the kidneys, the gastro-intestinal tract, the liver, the spleen and the lungs. It has often been detected in the urine.

The bacillus may gain entrance to the circulation in several ways—through lesions of the skin or mucous membranes (ear, nose, tonsils, accessory sinuses, gastro-intestinal tract, etc.), through the teeth, through the umbilicus, in infants, and possibly through the lungs. The intestinal tract has been regarded as a common source of infection by many observers, although actual demonstration is of course difficult, the idea being based upon the frequent finding of the germ in the stools and the apparent absence of all other sources of infection.

The following case is presented because of its unusual surgical aspects and its extreme chronicity—so far as I am aware, only one other instance of equally long duration having been reported (de la Camp).

The disease began acutely, but soon became chronic and lasted continuously for between ten and eleven months, finally ending in recovery, with the exception of a moderate paresis of the lower extremities, which is still undergoing improvement. It defied diagnosis by many physicians, both in Denver and Chicago, until finally its cause, the bacillus pyocyaneus, was discovered more or less accidentally, during the course of a cholecystostomy, and a curative vaccine administered.

CASE REPORT.—On November 22, 1914, the patient, a physician fifty-one years of age, experienced, without appreciable cause, a marked chill accompanied by purging and vomiting. There was severe headache and backache and the temperature rapidly mounted to 104.5°. Within 24 to 48 hours a considerable improvement took place, in which the fever almost disappeared and recovery seemed assured. At the end of another day or two, however, the temperature again rose to 102° or 103°, with daily exacerbations and remissions at irregular intervals. The headache and especially the backache were extreme and accompanied by great pain in the lower extremities, which was described as beginning at the hip and passing downward over the whole limb in a sort of "wave," which finally concentrated in the calf.

In three or four days from the inception of the attack there appeared on the right ankle a hard, red, raised wheal of considerable size, which was sore to the touch. In a few more days a reddish eruption broke out over the entire body, especially upon the extremities. It was maculo-papular in character, each spot being about the size of a pea. The trunk was only moderately affected and the face not at all, although there were a number of spots around the edge of the hairy scalp.

The eruption, together with the pain in the back and other symptoms, at first led to a tentative diagnosis of small-pox, which was soon changed, however, to erythema multiforma. In the third week there appeared an erythema nodosum, the nodules being tender and some of them as large as a twenty-five-cent piece. Even the soles of the feet and palms of the hands were affected. There were at no time any pustules and but one or two blisters.

This eruption occurred intermittently for about nine months, growing, however, gradually less. It would appear rapidly and then slowly fade until it almost disappeared between the attacks.

The pains in the limbs lasted for about six months, although varying greatly in intensity from time to time. They were particularly severe just before the exacerbations of the eruption, and seemed to be distinctly associated with it.

Gradually there developed a paresis of the lower extremities, with muscular atrophy, which persisted after recovery and still exists, at the end of over a year, to such an extent that the patient walks with some uncertainty and uses great caution in going up and down stairs.

Fever appeared daily, at irregular times, during the entire illness, occasionally as high as 104° or over, but usually from 101° to 103°. It was accompanied by severe chills and profuse sweats, followed by a sudden drop to far below normal, sometimes so far that it could not be registered. It always rose rapidly,

stayed at its highest point about half an hour, and then quickly declined (see Fig. 1). Sometimes there were intervals of a day or two when the fever almost if not quite disappeared and false hopes of improvement were entertained.

The result of the long illness was extreme weakness and emaciation, accompanied by considerable mental hebetude, although this did not appear for about six months. Constipation

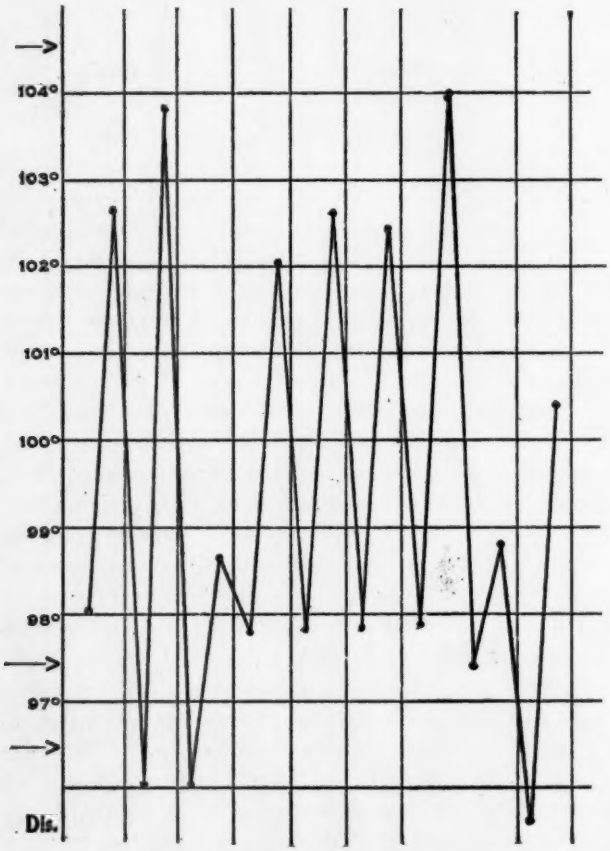


FIG. 1.—Typical excerpt from temperature chart, January 13 to 22, 1915.

was present throughout, following the short initial diarrhœa. The urine was always negative. No lesions of the ears, the nose or the accessory sinuses could be determined, either clinically or by the X-ray, and the heart sounds were always normal.

The diagnosis being doubtful, at the end of three or four weeks, the patient decided to go to Chicago, where he visited the clinic of Dr. John B. Murphy. After an exhaustive examination, in-

cluding blood tests, spinal punctures and animal inoculations, which were all negative, a diagnosis of Rocky Mountain spotted fever was made. Against this, however, were the facts that the patient had not been recently in a tick-fever district, and the season of the year when the disease began was at least two months too late for infection from ticks to occur. After returning to Denver the element of time soon definitely disposed of the diagnosis of spotted fever, and other causes for the trouble had to be sought.

At the end of three months, with the idea that pyorrhœa might be the source of the difficulty, an X-ray picture of the alveolar processes was taken, disclosing several pus pockets. An anæsthetic was then given and all of the teeth extracted, in order to remove with certainty every source of dental infection; but from this heroic measure, although justified by the seriousness of the disease, nothing definite resulted. It is quite possible, however, that the pyorrhœa may have been the original source of infection.

From time to time during the long illness, various blood examinations were of course made, including a Wassermann test, a von Pirquet test, leucocyte counts, bacteriologic investigations, etc., but nothing of practical importance was disclosed, although some two weeks after the disease began the proteus vulgaris was detected, but it was difficult to attach any especial significance to its presence and it was not found again. About this time, examinations of the blood, made by Drs. Hillkowitz and Hill, showed: hæmoglobin 80 per cent.; red corpuscles 4,200,000; white corpuscles 12,000 to 13,000; lymphocytes 9 per cent.; polynuclears 87 per cent. to 94 per cent.; large mononuclears 4 per cent.; microorganisms (smears and cultures) absent; typhoid and paratyphoid tests negative; and malarial plasmodia absent. The results of guinea-pig inoculations were negative.

At the end of about five months, attention was attracted to the gall-bladder by a moderate amount of tenderness and rigidity in that region. The patient also stated that for at least a year he had been subject to attacks of pain beneath the right costal margin, which were severe enough to prevent him from attending to his professional duties. Acting upon this somewhat indefinite clew, Dr. J. N. Hall, seconded by Drs. Carlin, Whitney and Arneill, urged an exploratory operation, which I performed on May 22, 1915, assisted by Dr. W. S. Bagot.

The gall-bladder was found to be much elongated, slightly thickened and whitish, and adherent to the colon. It was filled with very thick, black bile, about the consistency of cold molasses. There were no stones. A moderate cirrhosis of the liver existed and there was much clear fluid in the peritoneal cavity, although

this had not been detected previously. The pancreas, stomach and appendix were negative. After draining off most of the ascitic fluid, a cholecystostomy was quickly done, the patient's condition not being favorable to further exploration.

Cultures, made by Dr. Phillip Hillkowitz from the thick, black bile, under vigorous aseptic precautions, gave a pure growth of the bacillus pyocyaneus, from which a vaccine was made, 8,000,000 to the c.c. This was administered every five days, beginning with 1/10 c.c. and increasing the amount 1/10 c.c. each dose until 1 c.c. was reached, where the dosage was maintained. (The fact that the pyocyanic germ develops its coloring matter in the presence of oxygen only sufficiently explains why the bile was black and not green.)

From the beginning of the use of the vaccine the general trend of the temperature was downward, although it occasionally went to a moderate height, especially following the injection of the vaccine. The physical condition, however, was still one of great weakness which seemed even to increase for a time in spite of the gradual subsidence of the fever; but after a few weeks decided improvement set in and the temperature slowly descended to normal. At the end of nearly eleven months from the beginning of the perplexing and discouraging disease recovery was complete.

During the eighth month a left-sided, clear pleural effusion appeared; but after a single aspiration the fluid did not re-accumulate, its behavior being analogous to that of the ascites which permanently disappeared following the operation.

At the present time, March 24, 1916, the patient is in most excellent physical condition, with the exception of a moderate weakness of the legs which causes some uncertainty in walking, but is slowly improving. (Dr. Delehanty reports that the extensor muscles are much weaker than the flexor, and that the patellar reflex is absent, while the plantar is present.) Both liver and spleen seem to be normal in size and there is no evidence of ascites.

The diagnosis in this case was based upon:

1. The acute onset, with vomiting and purging.
2. The characteristic eruption.
3. The long-continued fever for which no other cause could be found.
4. The severe pains in the extremities followed by paresis and muscular atrophy.
5. The detection of a pure culture of bacillus pyocyaneus in the bile, where it would be most apt to be found.
6. Recovery under drainage of the gall-bladder and the prolonged use of a vaccine. (The vaccine treatment was originally

suggested by Charrin some thirty years ago and has since been used with apparent success—Groves, Barker).

7. The corroborative evidence of temporary ascites, cirrhosis of the liver and pleural effusion, which may all have been due to the pyocyanic infection and have been observed in similar cases. The most prominent point against the diagnosis was the absence of any marked hemorrhagic tendency, so frequently, but not always, found.

The features of especial interest in the case are:

1. Its extreme chronicity, having lasted nearly eleven months. Very few of these chronic cases have been reported. I have been able to find one by de la Camp (adult) lasting 18 months (death); one by Jadkewitsch lasting 4 months (adult) with paresis of both legs (recovery); one by Sudeck (adult) lasting 16 weeks (recovery); one by Hübener (adult) lasting 3 weeks; one by Kühn lasting 3 weeks (death); and one by Koslowski (adult) lasting 5 months (recovery).

2. The typical neuralgic pains followed by paresis and muscular atrophy. These have been frequently observed in both man and animals and are characteristic of the disease, but probably not pathognomonic, although so regarded by Charrin.

3. The absence of the bacillus pyocyaneus from the blood and its presence in the bile, which might be expected from the conditions under which it exists in the body. (The cutaneous eruptions and urine were not bacteriologically examined.)

4. The absence of any discoverable point of infection, unless it might be the teeth, making it possible that this was somewhere in the alimentary tract.

5. Recovery following drainage of the gall-bladder and the use of an autogenous vaccine.

6. The occurrence of cirrhosis of the liver. While this may have been due to other causes, it has nevertheless been observed in chronic pyocyanic infection (de la Camp), and seems to have disappeared since the recovery of the patient (Hall).

7. The presence of ascites and pleural effusion, which promptly disappeared, the former following an abdominal incision and the latter a single aspiration. Similar effusions from serous membranes, such as the pleura, peritoneum, pericardium, meninges and joints, have been reported by different observers.

8. The satisfactory recovery after so severe and protracted an illness, with the exception of a moderate paresis of the lower limbs, which seems to be improving.

LITERATURE

Barker: Jour. Am. Med. Assn., July, 1897, p. 213.
De la Camp: Charité Ann., 1904, S. 92.
Charrin, A.: La maladie pyocyanique, Paris, 1889.
Frankel, E.: Virch. Archiv, 1906, B. 183, S. 403.
Groves: Ref. Deut. med. Woch., 1909, S. 985.
Hübener: Deut. med. Woch., 1907, S. 803.
Jadkewitsch: Jahresber. ü. die pathogenen Mikroörganismen, 1890, S. 355.
Kühn: Centralbl. f. inn. Med., 1903, S. 577.
Kolle u. Wassermann: Handbuch der pathogenen Mikroörganismen, 1913, B. 5, S. 1185 (complete literature).
Sudeck: Münch. med. Woch., 1909, S. 1848.
Wassermann, M.: Virch. Archiv, 1901, B. 165, S. 342.

A FURTHER NOTE ON ETIOLOGY OF SURGICAL SCARLATINA*

By John B. Roberts, M.D.
of Philadelphia

In my note last year on the "Etiology of Post-operative or Wound Scarlet Fever" is recorded my belief that true scarlatina occurred sometimes by introduction of the infecting agent through a breach in the skin, instead of by the usual faucial or nasal route. My suggestion was that the reason no micro-organism had been proved to be the specific agent of infection was probably its ultramicroscopic size and filterable nature. I also suggested that the anginose affection termed scarlet fever might cover more than one specific infection.

Closer acquaintance with bacterial and protozoan causes of disease has recently proved the existence of infecting agents which produce a similar, but not identical, complex of symptoms, much to the confusion of medical nomenclature.

It is not difficult to accept the possibility of the scarlatinal infection reaching the blood of men through cutaneous wounds, if one recalls that tuberculosis and diphtheria sometimes present instances of this method of entrance; though scientific acquaintance with these morbific agents was recognized originally through diseases of the respiratory tract alone.

An exhaustive study by Alice Hamilton at the Memorial Institute for infectious diseases, in Chicago, about a dozen years ago, led her to the opinion that there was (1904) no convincing proof that the so-called surgical or wound scarlatina was anything more than typical scarlatina happening as a coincidence in a patient previously wounded. She believed that in many reported cases the condition was not scarlatina at all, but a septic process due to failure to maintain an aseptic course during the wound convalescence.

McCarty's paper published in 1914 records 43 post-operative eruptions in 1000 consecutive operations. After rejecting transient rashes, such as those due to general anæsthesia and those which appear within forty-eight hours, he studied the eruptions of sudden onset appearing three to seven days after operation and lasting from one to seven days. These had in his cases an average duration of four days. Those

* Read before the American Surgical Association, May 10, 1916.

beginning on the third or fourth day were the most severe and of the longest duration. In these there was no desquamation observed and in none were albuminuria or acetonuria found before or after operation; nor were casts detected in the urine in any patient in whom they were absent prior to operation.

McCarty thinks his cases show that post-operative eruptions are comparatively frequent, and that the underlying cause is a vasomotor disturbance probably due to irritation of the sympathetic nervous system. His late appearing eruptive group would seem to resemble many of the cases reported as surgical scarlatina.

It is probably true that sepsis or vasomotor influences are the cause of many cases of the so-called post-operative scarlet fever; and that many other instances of supposed infection through a cutaneous atrium are incidental infections in the ordinary way of non-immune persons, without relation to the existence of the prior cutaneous wound.

Several investigators have reported a discovery of the micro-organism which seemed to them scarlet fever's etiologic agent. The evidence, however, has not seemed conclusive to those competent to judge. The one most likely, according to expert opinion up to last year, is a streptococcus. There are so many varieties of streptococci, and differentiation thus far has been so difficult, that it is not improbable that the same organism may, alone or in association with other bacteria, be responsible for several clinical manifestations.

The pyogenic streptococcus, so familiar to surgeons, and that termed the streptococcus erysipelatis may perhaps be merely different strains of the same organism. Why may not that deemed to be responsible for the infection of scarlatina be the same or a close relation? Simple scarlatina is certainly a very different affair clinically from its so-called malignant form.

Clinicians see what seems to be an association of diphtheria and scarlatina in the same throat; the symptom-complex is in many cases attributed to a secondary streptococcus infection giving, with the evidences of the Klebs-Löffler bacillus infection, symptoms of streptococcus activity. Some anginose cases have been attributed, possibly incorrectly, to the affection called, by surgeons of an earlier period, erysipelas.

Is it not possible that palsy sometimes seen after scarlatina is due after all to the same etiologic agent that gives rise to the secondary palsy of diphtheria? Have not surgeons seen "erysipelas" more rife at the time of scarlatina epidemics? I think that I have, though my personal opinion is worthless. Indeed, the very term "erysipelas" should be abandoned as should "cancer"; but until the streptococcus

family can be better discriminated it is perhaps as well to retain the former term as it may be to retain the latter until malignant disease can be etiologically understood. Rosenberger has informed me that the antitoxin of diphtheria has seemed to him to be curative in a streptococcus infection of the throat where no diphtheria bacilli were discovered. Webster Fox has used diphtheria antitoxin with apparent success in sympathetic inflammation of the eye.

Returning to the question of wound scarlatina I must refer to the experimental work of Strickler of New Jersey, who about twenty years ago inoculated children with saliva of scarlatina patients and produced what he believed to be scarlatina. He was endeavoring to reach a means of immunization. I do not defend his scientific ardor, but merely state that he thought he had produced scarlet fever by inoculation through the wounded skin. It is possible that the symptoms were those of sepsis, though I am inclined to think he really caused true scarlatina. There are a few cases reported that seem to have been definite instances of wound or surgical scarlatina. One was that of a German physician seemingly immune through many contacts with scarlatina in professional practice, who acquired the disease after wounding his hand during the autopsy of a patient dead from unquestioned scarlet fever.

Several recent etiologic studies have been reported by investigators as holding out hope of the discovery of the organism causing scarlet fever. The latest, so far as I know, is that of F. B. Mallory and E. M. Medlar of Boston, detailed in the *Journal of Medical Research,* March, 1916. The work was done in the Pathological Laboratory of the Boston City Hospital. This Gram-positive bacillus, which is more decidedly Gram-positive than the diphtheria bacillus, is described and thought by them to be a true bacillus scarlatinæ. The coincident streptococcus infection often complicated the investigation. Mallory, years ago, thought the cause of scarlet fever to be protozoan; his interest in the subject continuing all these years seems to me to add force to the probable accuracy of his present investigation and the value of his opinions.

MELANOTIC CANCER*

WITH A REPORT OF 91 CASES

By William B. Coley, M.D.

ATTENDING SURGEON TO THE MEMORIAL HOSPITAL

AND

Joseph P. Hoguet, M.D.

ATTENDING SURGEON TO THE FRENCH HOSPITAL

OF NEW YORK

Melanotic sarcoma, or melanoma, one of the most common varieties of malignant tumors, was first described as occurring in horses, in the latter part of the eighteenth century (Bruguorne in 1784 and Latournelle in 1809). Laennec was the first to write about this type of tumor in man. In 1806 Laennec and Bayle published a report of cases of melanotic tumors of the lungs and other organs. Laennec regarded these tumors as accidental productions, representing one of the varieties of cancer, and divided them into four classes: (1) Tumor masses encased in cysts; (2) non-encapsulated tumor masses; (3) tumor masses infiltrating the tissues of an organ; (4) masses deposited upon the surface of an organ.

This rather artificial classification obtained for a long time, and for a number of years our knowledge of these tumors advanced but little, except for the study of veterinary surgeons, which showed that they usually occurred in animals with white skin, and that the condition was hereditary and capable of transmission from one generation to another.

The discussion as to the origin of these tumors from fibrous tissue or epithelium has been going on for a long time, and has not as yet been entirely settled. We know very little about the origin of malignant tumors and this is especially true of melanotic tumors. As far as our present knowledge goes, there is little evidence of heredity in this type in man. The great majority of melanotic sarcomas, aside from those in the eye or orbit, develop from congenital moles or pigmented warts; but there are some important exceptions which will be mentioned in the paragraph on primary site of the disease.

Trauma in the form of local injury, or more especially of repeated irritation, plays a very important part in the etiology of this group of

* Read before the American Surgical Association, May 10, 1916.

tumors. The effect of trauma has long been noted, Busch having called attention to it many years ago, and reported specific examples as far back as 1880 (*Berl. Klin. Wochenschr.,* 1880, No. xvi), and in our series of cases reported here, there are several cases which confirm the truth of this theory.

We believe that melanotic neoplasms are probably of an infectious nature; that they are due to some extrinsic cause, *e.g.,* some specific micro-organism or virus, which finds in the congenital mole that has been irritated or injured the most favorable conditions for development. We do not believe that the pigment or melanin is the sole cause of the proliferation of the cells, as held by some writers, but rather, that some micro-organism excites the cells to the production of the characteristic pigment.

Recently published observations on the "Etiology of Sarcoma in the Rat," by Albert S. Leyton (Prof. of Pathology, University of Leeds) and Helen G. Leyton, lend support to this theory. While it was hitherto known that certain sarcomata in animals, as, for instance, the chicken sarcoma (Peyton Rous) had a filterable virus capable of producing the disease by inoculation, it remained for the Leytons to prove that the same is true of rat sarcoma. Their experiments were carried out as follows: An emulsion of sarcoma was passed through a Chamberland filter and eighteen rats were inoculated with this filtrate. In four, a tumor exactly similar to the original spindle-celled sarcoma developed. They hold that the active cause of this rat sarcoma is a streptothrix, and while it may not be possible for this organism to pass through a Chamberland filter, it produces spores which do pass through. They also add, in order to test the relationship of the streptothrix to the formation of sarcoma, several rats were fed with it weekly for some time; so far, a tumor has resulted in one of the fed rats only. In the mediastinum was a growth about the size of a cherry, together with several smaller ones, which had all the characters of a spindle-celled sarcoma and was inoculable.

At present the most uncompromising opponents of the theory of the microbic origin of cancer are willing to concede that not only Hodgkin's disease, but lymphosarcomas as well, are of infectious origin. We believe that possibly in the future, other groups of malignant tumors may be taken out of the general group of "cancer" and placed in the same category as "infectious granulomata."

The experimental production of tumors in plants by inoculation of a specific bacterium, by Dr. Erwin F. Smith (Bureau of Plant Pathology, Washington, D. C.), is, we believe, of extreme importance and may

have a bearing upon the question of the etiology of human tumors. These tumors in histological structure and metastases furnish a striking analogy to malignant tumors in animals and in man. The most remarkable feature of these tumors is the fact that it has been found possible to produce the different types from the same micro-organism by simply varying the site and depth of inoculation. One type of tumor that the opponents of the parasitic theory of tumors have always regarded as impossible to explain on the basis of any other theory but that of Cohnheim has been the teratoma. Yet very recently Dr. Smith has demonstrated that he could also produce a typical teratoma or embryoma in plants by simply inoculating the organism at the site of a latent bud between the leaf and the stalk. The results of these experiments he has just reported in a paper read before the American Cancer Research Society, May 7, 1916. He also showed numerous examples of these tumors growing in plants, in the Bureau of Plant Pathology. Of course it is possible to deny any analogy between tumors in plants and tumors in man, but no one can examine these tumors microscopically and study their development in the plant itself, without being deeply impressed with the possibility of such analogy.

Becheaux (Paris Thesis, 1908–1909) in discussing the contagiousness of malignant melanotic tumors states that for a long time efforts have been made to ascertain whether they were contagious and inoculable.

Goujon injected fresh material from melanotic tumors in man under the skin of different animals, with the result that within a certain time the disease developed and became generalized in all of the animals.

Klerck was able to produce melanotic tumors in one horse and then another, by inoculation. Eiselt observed a hostler who contracted the disease while taking care of horses suffering from melanotic tumors. Later, Queyrat inoculated two monkeys, one under the peritoneum, and the other under the skin, with fragments of melanotic sarcoma. The inoculations gave positive results and the animals died of the disease at the end of two and two and one-half months, respectively. Other experimenters have also been able to obtain positive results from inoculation.

Becheaux believes that these facts are sufficient to give a serious point to the theory of Bard, who believes in the existence of a special form of micro-organism which is the cause of melanotic sarcoma.

In connection with Case XIV we would state that in 1895, Dr. B. H. Buxton (late Prof. of Experimental Pathology, Cornell University Medical College) and one of the writers (Coley) experimented with inoculations of melanotic sarcoma in rabbits. Numerous small subcutaneous melanotic tumors were removed from the above case, and under strict aseptic precautions were ground up and inoculated into the peritoneum in three rabbits. The latter were also fed upon pulverized

portions of tumor spread upon lettuce leaves. Within three months all of the rabbits died, and in each case the liver was found to be filled with multiple tumors, the pathology of which was uncertain; they were grayish-white in appearance with no pigmented areas, and varied in size from one-eighth to one-half inch in diameter. It could not positively be determined whether they developed as a result of the inoculation, or whether they were examples of independent coccidial disease. They were not regarded as true tumors by the pathologist who examined the specimen.

In one of our most recent cases (Case XXIV) a series of inoculations was carried out by Dr. Richard Weil, with entirely negative results.

Pathologically all melanosarcomata are characterized by the fact that they contain a pigment, brown or black in color, which is a product of cell metabolism and which usually contains no iron. This melanin is found in the cells themselves or in the intercellular substance, and usually is present in the form of granular matter. The tumor itself is made up of cells which may be round, spindle-shaped, quite irregular in outline, or very large in size (giant-cells). In many of these tumors there is a tendency for the cells to assume an alveolar arrangement. Whether in this type of tumor the cells are of epithelial or connective-tissue origin has not as yet been entirely settled.

Müller regarded melanotic tumors as carcinomas; Lebert as simple cancer. Stromeyer was the first to term them melanotic sarcomata, and later on, Virchow established the existence and frequency of such tumors and regarded the majority as sarcoma, but also recognized cases of carcinoma. Johnston, in his paper in the *Journal of Cutaneous Disease,* 1905, says:

> Aside from the natural division into choroid and skin tumors, melanotic neoplasms, which from their diversity of origin are best called melanomas, show several varieties:
>
> 1. The commonest and therefore most important is that derived from soft nævi which are endotheliomas of lymph-vessel origin.
>
> 2. A second variety exists with the same histologic picture which does not spring from nævi and whose origin is directly traceable to endothelioma, probably also lymphatic. These tumors are probably primary in the lymphatic vessels or glands.
>
> 3. The third division is truly epithelial in origin. These tumors are of various types and show only a very slight tendency to malignancy, a fact sufficient in itself to determine a cardinal difference from the melano-endotheliomas, whose capacity in this connection can hardly be exaggerated.

The majority of investigators now believe that these tumors are of ectodermal origin. A very strong point in the determination of the

kind of cells that these tumors spring from is the pigment formation. Wieting and Hamdi (*Beitr. z. Path. Anatomie,* 1907, vol. xlii) say that they consider pigmentation around ulcers the result of chronic irritation which, according to the manner and the place of irritation, leads to increased production of corneous substance, or proliferation of the epithelium, or to over-production of pigment. The pigmentation due to the Röntgen rays and the sunlight must be explained in the same manner. It is probable that melanotic tumors arise from epithelial cells which, as a result of limited embryonal malformation as regards function, possess exceptional pigment-forming qualities, which are increased by the abnormal proliferation. They hold that excessive production of pigment is an expression of pathologically increased function of the cell, which ends with its death; and investigation as to normal and pathological pigmentation forces them to recognize only an epithelial pigment formation.

Borst (*die Lehre v. d. Geschwol.*) says that all melanoblastomas occurring in the realm of the ectoderm can easily be explained genetically. He also says that he does not hesitate to credit the entodermal epithelium with the capacity to form pigment.

Mallory classes melanomas as sarcomas and believes they originate from connective-tissue cells.

A careful study of the most important literature on the subject shows that at present it is impossible to formulate any definite accepted classification, based upon the histological structure, and the report of a case by Leo (*Société de Chir. de Paris,* 1912, 1007) illustrates the difficulties in this connection. His case, clinically, resembles very closely the ordinary type of so-called melanotic sarcoma. The histological structure was very carefully studied by Dr. Herrenschmidt, who stated that nothing in the architecture of the neoplasm or in the morphology of the melanin-bearing cells permitted one to state positively that it was a sarcoma or an epithelioma. Certain features of the case would justify one in calling it an alveolar melanotic sarcoma, and other points would quite as well justify one in calling it "*atypique melanome epitheliome.*" For those who preferred to reserve their opinion on the histology of the tumor, he suggested calling it a "*melanome congenital atypique.*"

Our own cases seem to justify the view that certain melanotic tumors are apparently of connective-tissue origin and might properly be called melanotic sarcoma. Other cases are equally as clearly of epithelial origin, and in certain other cases, like Leo's, it is almost impossible to determine in which type of cell the tumor originated.

Possibly the most rational method of dealing with these cases is to classify them all as malignant melanomas or melanotic cancer, without attempting too closely to determine the exact point of origin.

W. Sampson Handley, author of the "Hunterian Lectures on Melanotic New-growths" (*Lancet*, 1907, 927–996), although originally of the opinion that these tumors were of epithelial origin, after a most careful study is now strongly of the belief that practically all melanotic new-growths are of connective-tissue origin. This view is also held by Ribbert who has also made a most thorough study of the subject.

Eve, basing his views chiefly on clinical observations, holds that these tumors are practically all of epithelial origin, and points out many clinical features in which they resemble carcinoma.

Chalier and Bonnet say that primary melanosarcomas of the rectum originate in the endothelial spaces of the submucosa, infiltrating both into the muscularis and the mucosa, breaking through the latter and ulcerating. The whole process probably arises from the inclusion of epithelial cells; hence these authors conclude that these tumors are epitheliomata of the malpighian or ectodermal type arising in the anal region from malpighian epithelium.

At the present time, opinions are of such wide diversity that it is impossible to express any positive view as to the classification of melanotic new-growths. From our own observations, we are inclined to the belief that there is a measure of truth in both theories. The majority of tumors are probably of connective-tissue origin, while a certain number are epithelial.

The life history of these tumors is very variable. In the great majority of cases a pigmented mole is the starting point of the disease. This mole may have been present for years without undergoing any change, but it gradually begins to ulcerate, its base becomes indurated or slightly elevated, and it may increase slightly in size. Within a very short time the nearest glands become swollen and increase fairly rapidly in size. The skin over the glands may become bluish-black in color and finally its surface may ulcerate, allowing the discharge of characteristic bluish-black material. In many cases the glands in the neighborhood do not enlarge very much or very rapidly, but a large number of nodules are found all over the body under the skin. Metastases may occur in the internal organs, lungs, liver, spleen, kidneys, and the brain. Hand in hand with the appearance of metastases, there is a rather slow progressing loss of strength and weight, together with an ever increasing anæmia.

When the primary tumor has been in the eye, the favorite site for

kind of cells that these tumors spring from is the pigment formation. Wieting and Hamdi (*Beitr. z. Path. Anatomie,* 1907, vol. xlii) say that they consider pigmentation around ulcers the result of chronic irritation which, according to the manner and the place of irritation, leads to increased production of corneous substance, or proliferation of the epithelium, or to over-production of pigment. The pigmentation due to the Röntgen rays and the sunlight must be explained in the same manner. It is probable that melanotic tumors arise from epithelial cells which, as a result of limited embryonal malformation as regards function, possess exceptional pigment-forming qualities, which are increased by the abnormal proliferation. They hold that excessive production of pigment is an expression of pathologically increased function of the cell, which ends with its death; and investigation as to normal and pathological pigmentation forces them to recognize only an epithelial pigment formation.

Borst (*die Lehre v. d. Geschwol.*) says that all melanoblastomas occurring in the realm of the ectoderm can easily be explained genetically. He also says that he does not hesitate to credit the entodermal epithelium with the capacity to form pigment.

Mallory classes melanomas as sarcomas and believes they originate from connective-tissue cells.

A careful study of the most important literature on the subject shows that at present it is impossible to formulate any definite accepted classification, based upon the histological structure, and the report of a case by Leo (*Société de Chir. de Paris,* 1912, 1007) illustrates the difficulties in this connection. His case, clinically, resembles very closely the ordinary type of so-called melanotic sarcoma. The histological structure was very carefully studied by Dr. Herrenschmidt, who stated that nothing in the architecture of the neoplasm or in the morphology of the melanin-bearing cells permitted one to state positively that it was a sarcoma or an epithelioma. Certain features of the case would justify one in calling it an alveolar melanotic sarcoma, and other points would quite as well justify one in calling it "*atypique melanome epitheliome.*" For those who preferred to reserve their opinion on the histology of the tumor, he suggested calling it a "*melanome congenital atypique.*"

Our own cases seem to justify the view that certain melanotic tumors are apparently of connective-tissue origin and might properly be called melanotic sarcoma. Other cases are equally as clearly of epithelial origin, and in certain other cases, like Leo's, it is almost impossible to determine in which type of cell the tumor originated.

Possibly the most rational method of dealing with these cases is to classify them all as malignant melanomas or melanotic cancer, without attempting too closely to determine the exact point of origin.

W. Sampson Handley, author of the "Hunterian Lectures on Melanotic New-growths" (*Lancet*, 1907, 927–996), although originally of the opinion that these tumors were of epithelial origin, after a most careful study is now strongly of the belief that practically all melanotic new-growths are of connective-tissue origin. This view is also held by Ribbert who has also made a most thorough study of the subject.

Eve, basing his views chiefly on clinical observations, holds that these tumors are practically all of epithelial origin, and points out many clinical features in which they resemble carcinoma.

Chalier and Bonnet say that primary melanosarcomas of the rectum originate in the endothelial spaces of the submucosa, infiltrating both into the muscularis and the mucosa, breaking through the latter and ulcerating. The whole process probably arises from the inclusion of epithelial cells; hence these authors conclude that these tumors are epitheliomata of the malpighian or ectodermal type arising in the anal region from malpighian epithelium.

At the present time, opinions are of such wide diversity that it is impossible to express any positive view as to the classification of melanotic new-growths. From our own observations, we are inclined to the belief that there is a measure of truth in both theories. The majority of tumors are probably of connective-tissue origin, while a certain number are epithelial.

The life history of these tumors is very variable. In the great majority of cases a pigmented mole is the starting point of the disease. This mole may have been present for years without undergoing any change, but it gradually begins to ulcerate, its base becomes indurated or slightly elevated, and it may increase slightly in size. Within a very short time the nearest glands become swollen and increase fairly rapidly in size. The skin over the glands may become bluish-black in color and finally its surface may ulcerate, allowing the discharge of characteristic bluish-black material. In many cases the glands in the neighborhood do not enlarge very much or very rapidly, but a large number of nodules are found all over the body under the skin. Metastases may occur in the internal organs, lungs, liver, spleen, kidneys, and the brain. Hand in hand with the appearance of metastases, there is a rather slow progressing loss of strength and weight, together with an ever increasing anæmia.

When the primary tumor has been in the eye, the favorite site for

metastases is the liver. The involvement of this organ may occur years after the enucleation of the eye or may appear almost immediately. In these cases the other organs are involved shortly after the liver, and subcutaneous tumors appear also. In many cases metastases, whether lymphatic, internal, or subcutaneous, may occur when the original tumor is of such small size that the patient does not even consult a physician about it. There is also the class of cases which, on account of our inability to find a primary focus, we are forced to call primary in the lymphatic system. As will be seen from our list of cases, most of these are in the cervical glands and seem to be of an especially malignant character, causing death in a short time.

The manner of extension of melanotic neoplasms beyond the primary focus of the disease differs somewhat from that observed in other types of cancer. This extension has been very clearly described by Sampson Handley, *loc. cit.* There is no reason to doubt the characteristics in melanotic tumors, which, he states, usually extend in two ways: First by the permeation method (already described by Handley in reference to carcinoma of the breast), that is, a centripetal distention into the lymph-vessels and spaces covering the deep fascial planes; second, the involvement of the vessels, usually the neighboring veins, with the destruction of the walls of the vessels; the formation of thrombi which later permit the escape of small emboli which spread the disease to all parts of the body, most frequently the liver and the lungs.

A few cases have been reported in which marked spontaneous regression of melanotic growths has taken place. In all of these cases, we believe, this regression has proven only temporary. The most remarkable case is that of Sir Alfred Pearce Gould, reported by Handley, *loc. cit.:* A very large number of subcutaneous melanomata disappeared in the course of a few months, but the patient later died of internal metastases. It is only fair to state, that the patient during this period was taking a preparation of Venetian turpentine and sulphur.

The duration of life in our cases was found to be very variable. The most malignant tumor we have in our series was one which appeared in the axillary glands, causing the death of the patient in one month from the time of its appearance. We also find a case where death occurred in nine months, and in another in eighteen months. The majority of cases last from two to three years, but we have several cases which lasted from eight to ten years.

While nearly all of the text-books and authorities on cancer state that malignant tumors of the melanotic type are primary in the skin.

the matrix of the nail, or the eye, careful investigation shows that in a small group of cases the tumor originates at other sites and in other structures.

Eberman of Petrograd (*Deut. Zeit. f. Chir.,* 1896) reports 30 cases of melanoma, 4 of which were primary in the rectum, and 2 in the lymphatic glands.

Wieting and Hamdi (*loc. cit.*) report a large number of such cases with specific references. Among these are: Melanosarcoma of the intestine by Treves; of the liver by Fredrichs and v. Block; of the rectum, by Wiener; of the uterus, by Williams; of the bladder, by Thompson; of a subaxillary lymph-node, by Cecca; of the bone-marrow, by Rindfleisch; of the mammary gland, by Langenbeck; of the œsophagus, by Baur, as well as a number of others.

Chalier and Bonnet in the *Revue de Chirurgie,* 1914, reported a large number of cases in which the disease was primary in the rectum.

Eve states there is one case on record of a primary melanoma of the spinal cord. We have in our own series a case of melanosarcoma of the rectum, one of the breast, and five cases in which the tumor was apparently primary in the lymphatic glands. In these cases no other site of origin could be found during the course of the disease; but it is only fair to state that no autopsy was made in these cases. Eve cites one case in which autopsy failed to reveal any other focus of the disease, until at the end, the last portion of the rectum was examined and a small melanotic tumor was found, situated a short distance from the anus.

The prognosis of melanotic tumors has been regarded almost universally as hopeless. Boulay (*Archives Générales de Médecine,* July, 1888) has made an exhaustive study of the prognosis in this variety of tumors. He states that Dupuytren laid down the principle, that operation is contra-indicated in melanotic cancer, and Velpeau, Cruveilhier, and Virchow express the same views with regard to the prognosis of these tumors. From their statistics, as well as those of Cornil and Trasbot, conclusion is drawn that the prognosis of melanotic tumors is fatal, and that the patient is better without surgical intervention. The reason against operation is the fact that the disease remains local for such a short time, usually becoming generalized before surgical operation is considered.

In spite of the opinion of these distinguished authorities, Boulay believed that a large number of cases will be found in which operation has been performed successfully, and a study of which ought to throw some light upon the question of the value of surgical intervention.

Boulay states that the dangers of surgical intervention did not seem to have much effect in arresting the hands of the surgeons. It appears, on the contrary, that the well-known malignancy of these tumors when left to themselves, has, in a way, influenced the surgeon to make as complete an extirpation as possible.

Dietrich, in *Langenbeck's Archiv,* for 1887, expressed the ideas of his superior, Czerny, in advising a wide extirpation of melanotic tumors, the only

contra-indication to this procedure being cachexia. He believed that the advantages of the operation were: a favorable influence upon pain and hemorrhage and, in certain cases, prolongation of life, if nothing more.

By a careful study of the cases reported between 1880 and 1888, in which surgical operation was performed, Boulay attempts to settle the question of the wisdom of surgical intervention. He divides his statistics into cases subjected to surgical intervention and those in which no operation was performed. In his series of 191 cases, in which an abstract of the patient's history is given, we find that 152 were operated upon and 39 cases were treated without operation. In the foregoing number of cases operated upon, no data regarding the late results are given in 37 cases. As regards the remaining 36 cases mentioned as having survived the operation, recurrence or generalization of the disease took place shortly after; the remaining 19 cases were free from local or general recurrence, and reported as having been cured.

Boulay divides his series into three groups, the first, showing the interval which elapsed between the date of operation and the time of recurrence, viz.:

Less than 2 months	11 cases
From 2 to 6 months	12 cases
From 6 to 12 months	6 cases
From 12 to 15 months	3 cases
	32 cases

Second group, showing the period which elapsed between the operation and death:

Fifteen days and less	12 cases
From 15 days to 1 month	4 cases
From 1 to 6 months	17 cases
From 6 to 12 months	7 cases
From 1 to 2 years	1 case
From 2 to 3 years	1 case
Ten years	1 case
	43 cases

In the above group, 40 died after a period of one year from the time of operation. The average duration of the disease before operation was 6 to 7 months. In 15 cases the operation was supposed to have been followed by a cure.

The more important question now arises as to how long a period after operation a patient suffering from a melanotic tumor must remain free from recurrence before being regarded as a cure. Three years' freedom from the disease has generally been considered by the profession as a sufficient period after which to justify classifying the case as a cure. One of the cases cited by Boulay remained well for ten years after operation, and finally died from generalization of a melanotic sarcoma, and in two cases cited by Eve (both of the eye) recurrence took place after 5 and 10 years, respectively.

In 19 of Boulay's cases, which had remained well, the period of observation is given as follows:

4 days	1 case
7 days	1 case
5 months	2 cases
1 year	3 cases
1 year, 2½ months	1 case
2½ years	1 case
3 years	2 cases
4 years	1 case
4½ years	2 cases
5 years	1 case
5½ years	1 case
9 years	1 case
12 years	1 case
Unknown	1 case
	19 cases

Accepting the three-year standard, we have 9 cases of the entire series that can be classified as "cures" after operation.

Boulay believes that in many cases the disease is primary in the viscera and that the external tumor which causes the patient to consult a surgeon is really a secondary affair.

In conclusion, Boulay states that in this present series of cases, permanent cures, or at least successes, have been obtained by a wide extirpation of the primary disease—although the number has been comparatively small. On the other hand, he believes that in many cases surgical intervention has not only been useless, but distinctly harmful, the life of the patient having been decidedly shortened as if a violent stimulus to the activity of the disease had been given. He concludes that the question of the curability of melanotic tumors has made no progress, but if one decides on surgical intervention, one must reject everything in the way of half-measures—cauteries and ligatures should never be used, but as complete an extirpation as possible should be done.

Treatment.—So far as treatment is concerned, by far the most important question is that of prophylactic treatment. Inasmuch as the great majority of melanomas have their origin in a pigmented mole that has undergone either chronic irritation or is the site of a recent trauma, it would seem rational to advise the removal of all moles, particularly those that have been injured, or are located in exposed portions of the body.

We believe it very important to choose the best method of removal of such moles, for in many cases in our own experience, the injudicious methods of removal have apparently been the exciting cause of the melanoma. This particularly refers to the method of removal with silk ligature, electric cautery, or liquid air. Free excision with the knife, including a portion of the underlying skin and fascia, is, we believe, the best and safest method of procedure. It is possible that

the mole can be easily and quickly removed by single doses of radium, but whether or not the irritation caused by the radium might be a predisposing cause in the development of a melanoma is a question on which we have not sufficient data to make it possible to answer at the present time. Personally, we believe the use of radium or X-rays in a pigmented mole or in an operable melanoma a most unwise procedure and attended with grave risks.

Unfortunately, the surgeon rarely sees a primary melanoma at a period when surgery might offer some hope of a permanent cure. In the early stages of the disease, when the mole has begun to show signs of irritation or ulceration, the patient first consults the family physician who, because of the rarity of the condition, fails to appreciate its gravity, and either ties off the mole with a silk ligature or applies some caustic, like nitrate of silver or liquid air, which only increases the irritation and hastens its transformation into a highly malignant tumor. It is only when the disease begins to recur locally or systemically, that the patient is referred to a surgeon, and at this stage surgery can accomplish little or nothing in the way of a permanent cure.

If the disease is seen in the early stage, the method of operation advocated by W. Sampson Handley of London (in 1909) is undoubtedly the best: Excision of the tumor together with a very wide margin of the skin, including all of the underlying fascia, and a careful dissection of the nearest lymph-glands whether they are palpably enlarged or not.

For many years, the X-rays have been tried in a number of cases of this type of malignant tumor, at the Memorial Hospital. In some, marked inhibition of the growth followed, but the improvement was only temporary and after a few months (in one case a year) the disease ran its course.

As far as known, no very large number of melanomas have been treated with radium; certainly but a few with large doses of radium. One case at the Memorial Hospital (treated by Dr. Janeway), a melanoma apparently starting in the nasal cavity and involving the antrum, showed marked improvement under the combined treatment of ligature of the external carotid, followed by a course of radium treatment. The disease was almost completely controlled for several weeks, but then began to progress rapidly, causing death a few months later; no autopsy was obtained.

The mixed toxins of erysipelas and bacillus prodigiosus have been tried in 21 cases of inoperable melanotic growths by one of the writers. In not a single case, however, has a permanent cure been obtained unless such can be claimed in the case later described in detail, in which

the toxins were used for a supposed recurrence after operation, and in which the patient has remained well up to the present time, six years later. In this case there is considerable doubt as to whether the condition found at the time was a recurrence or not.

On the other hand, it should be stated that marked retardation of the disease in a number of cases in which the toxins were used has been observed, and more important still, that in four authentic cases undoubted recurrent and inoperable melanotic malignant tumors have disappeared under the injections of erysipelas and bacillus prodigiosus without other treatment. In two of these cases, the first treated by Dr. Greenwood of Leeds, England (*Lancet*, January, 1912), the patient is still well, upwards of five years, and in another, treated by Dr. Howard Lilienthal of New York, the patient is now well over ten years after. In the third case, that of Dr. Bunts of Cleveland, Ohio, disappearance of the tumor took place under the use of the toxins, but the patient died of metastases in the brain, nine months later (no local recurrence).

In the fourth case, Dr. Geo. R. Fowler's, the patient remained well two years, then had a recurrence which proved fatal.

These cases are too few to offer much hope of a cure of inoperable melanoma, yet they furnish sufficient evidence of the inhibitory action of the toxins, in our opinion, to justify a routine method of treatment with the toxins in all cases after primary operation, in the hope of lessening the number of recurrences.

The case treated by Dr. Howard Lilienthal of New York, is perhaps the most important of all, showing the curative value of the toxins in this type.

CASE I.—This case was first reported by Dr. Lilienthal in the ANNALS OF SURGERY (1903, vol. xxxvii, p. 440), who stated that the tumor started in the region of the seventh rib, and extended so that it involved a considerable portion of the eighth rib as well. An attempt at surgical removal was made on November 15, 1901, at which time the whole seventh rib, together with a considerable portion of the eighth, was removed. The pleura was involved to such an extent that no attempt at radical operation was made, and the wound was closed with drainage. Shortly after, the tumor reappeared in the line of the cicatrix, and the patient's general condition markedly declined. At this time the patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus (Coley). The initial dose was one-half minim, which was gradually increased up to five minims, which produced a severe reaction. The treatment was kept up for eight weeks. Almost immediately

after the first few injections, the tumor began to decrease in size, and his general health showed signs of improvement. By the time the treatment was discontinued, the tumor had entirely disappeared and the patient had completely recovered his normal health. He is in good health at the present time, fifteen years later.

A specimen of the portion removed was submitted to Dr. F. S. Mandlebaum (Pathologist, Mt. Sinai Hospital), who reported that "the tumor is a pigmented sarcoma of the mixed fibromatous type; the prominent feature of the tumor is the infiltration of the sarcomatous tissue with pigmented cells."

CASE II.—Greenwood. This case has already been published in the "*Lancet*" of January 19, 1912, p. 25, but it is so important, that it is worthy of brief reference, to which we are able to add the subsequent history of the case.

Mr. J. B. was operated upon for melanotic sarcoma of the neck in February, 1911. The operation was incomplete. The tumor recurred almost immediately and grew rapidly. By March 3, 1911, when the toxins were begun, it was $2\frac{1}{2} \times 2$ inches in size. The initial dose was $\frac{1}{2}$ minim, which was gradually increased up to 10 minims. He received 36 injections from March 13 to July 11, all of which were made in the neighborhood of the tumor. Immediate improvement was noted which continued until July 11, when no trace of the disease remained. According to my advice the injections were continued until April, 1913, or a period of two years and one month, during which time he received 105 treatments. The highest dose was 15 minims. The microscopical diagnosis of the tumor removed at operation was melanotic sarcoma.

In a letter dated July 16, 1913, Dr. Greenwood states:

"Mr. B. is in splendid health, doing full work, and now weighs 12 pounds more than in 1911. The site of the tumor is marked by a hollow covered by clean scar, with no trace of pigment."

In a letter dated April 14, 1916, Dr. Greenwood states:

"Mr. B., the case of melanotic sarcoma treated with your toxins in 1911, remains absolutely free from any recurrence and enjoys excellent health."

This case is so remarkable that it is important to be sure that there was no error in diagnosis. With reference to this Dr. Greenwood states:

"The report of the pathologist was so precise, and the clinical features so unmistakable that the patient's life was quite despaired of, and there was neither tumor nor slide kept—it is a pity. The treatment was only used (without faith) to convince the relatives that every means had been tried."

I believe that the good result in this case was partly due to the

long period (two years) over which the toxins were continued.

CASE III.—The history of the third case I owe to the courtesy of Dr. Frank E. Bunts of Cleveland: E. C., male, aged fifty-one years. Family history negative. In April, 1912, he noticed a small nodule on the plantar surface of the small toe on the left foot. February, 1913, the toe was amputated. Diagnosis: Angiomelanosarcoma. During the summer of 1913 he noticed a nodule on the upper surface of the next toe. Second operation November 4, 1913. The toe was amputated with several other nodules in the foot. Two weeks before the second operation he had noticed two lumps in the left groin. Ten days later these were removed, followed by X-ray treatment of the groin up to the time of the third admission, October 24, 1914. Operation October 24: Inky black fluid drained from groin.

Microscopic Diagnosis.—Melanosarcoma.

The growth in the groin became larger in spite of X-ray treatment and the leg became hard and swollen, so that the thigh was at least one-half again the size of the opposite one. The wound in the groin had not healed over, but was filled with a black fungoid mass. Dr. Bunts adds that he had considerable difficulty in securing the toxins from the manufacturer, as they had to make them up fresh, and after the exhaustion of the first amount received, three weeks intervened before he could get some more. The injections were begun January 19 and given as follows:

First injection	½	minim
Second injection	1	minim
Third injection	2	minims
Fourth injection	4	minims
Fifth injection	6	minims
Sixth injection	9	minims
Seventh injection	13	minims
Eighth injection	13	minims
Ninth injection	15	minims
Tenth injection	16	minims
Interval of three weeks.		
Eleventh injection	6	minims
Twelfth injection	14	minims
Thirteenth injection	19	minims
Fourteenth injection	22	minims
Fifteenth injection	23	minims

Dr. Bunts states:

Improvement in the local condition became evident in about a week or ten days after the beginning of the injections. The patient was discharged on March 8, 1915, with the swelling in the thigh practically all

gone and the wound in the groin healed over with the exception of an area of perhaps ¼ inch in diameter. This had subsequently healed when I saw him on May 21. At this time there was no evidence of a recurrence of the growth.

It is important to note the rapid increase in the dose as shown by Dr. Bunts' records. We are inclined to believe that the great improvement in this most unpromising case is probably due to this very increase in dosage, much more rapid than we have generally considered to be safe. Instead of increasing by ½ minim each time, the dose was increased, in some cases, by 3 to 4 minims, and in one instance by 8 minims.

In spite of this favorable immediate result, the patient died in December, 1915, of what was regarded and believed to be cerebral metastases, but without local recurrence, as Dr. Bunts just informed us.

The only favorable results (not cures) that have been personally obtained with the toxins in melanotic sarcoma, were observed in the following three cases, the first of which has some similarity to the case of Dr. Bunts.

CASE IV.—E. R. D.,[1] male, fifty-three years of age, was referred to Dr. Coley by Dr. W. J. Mayo on February 20, 1912, with the history that 3 to 4 years ago he had noticed a mole on the left fourth toe. Two years and nine months ago it had been removed by operation. Two months before, he had noticed an enlarged gland in the groin. This grew with great rapidity and was removed at the Mayo Clinic in the early part of February, 1912. The report of the microscopical examination made by Dr. L. B. Wilson reads as follows:

The tumor is a pigmented sarcoma composed of medium-sized round-cells and oval epithelial-like cells, the latter in many areas presenting an alveolar arrangement. Without entering into the question as to whether these tumors are epitheliomata or sarcomata, there seems to me no doubt that this tumor was a metastasis from the neoplastic change in the pigmented mole previously removed from the fourth toe of the patient's left foot.

The operation was incomplete and the patient was referred to me by Dr. Mayo for the toxin treatment. Physical examination at this time showed in the left groin a partly ulcerated mass of the

[1] This case has been reported in full in the Transactions of the Third International Conference of Cancer Research at Brussels, August 1–5, 1913.

appearance and consistence of melanosarcoma, 2 × 3 inches in diameter. At the end of one month's treatment the tumor had entirely disappeared and the wound had healed. The patient died on October 20, 1912, apparently from metastases in the right hemisphere of the brain—again closely resembling the case of Dr. Bunts.

The following case is reported in some detail, for the reason that it is one of two cases of our series in which the patient lived more than three years after operation. Whether or not the mixed toxins of erysipelas and bacillus prodigiosus (which were given as a prophylactic after primary operation, for nearly two years) were a factor in preventing or delaying a return of the disease, is a question that can never be answered with certainty.

CASE V.—Miss A., aged seventeen years, family history negative, was referred to me by Dr. Stuart McGuire of Richmond, Va., in May, 1912, with the following history:

In the early part of 1912, patient first noticed a small tumor in the upper and outer aspect of the thigh, which steadily increased in size until it had reached the size of a hen's egg. Dr. McGuire states that on April 30, 1912, under general anæsthesia, he excised the growth by an elliptical incision, going well outside the indurated area. The tumor did not extend to the fascia and was removed very completely. Microscopical examination showed it to be a melanotic sarcoma with a very few pigment cells.

Physical examination, by Dr. Coley, May 17, 1912, showed a recent cicatrix in the upper anterior portion of the left thigh, seven inches long. No enlargement of the glands in the groin, no swelling in the region of the wound. The toxins were begun on May 17; ½ minim produced a considerable reaction. The patient proved very susceptible and it was impossible to increase the dose more rapidly than by ¼ minim, which caused a severe chill and temperature of 103°. The patient returned home shortly after, where the toxins were continued by the family physician, Dr. R. C. Fravel, of Richmond, Va. The treatment was carried on for nearly two years, during which time she received upwards of one hundred injections.

A letter dated April, 1916, states that the patient is still well and free from recurrence after four years.

CASE VI.—Case of Dr. T. S. McDermott,[2] New Haven, Conn. A brief abstract of the case is as follows:

[2] For full details see paper by Coley on "A Report of Recent Cases of Inoperable Sarcoma Treated with Mixed Toxins of Erysipelas and Bacillus Prodigiosus," reprinted from Surg., Gynæcol. and Obstet., August, 1911.

Female, adult, was operated upon for sarcoma of choroid, December, 1904, at Boston City Hospital, the eye being enucleated. She remained well for two years, when a small growth was noticed in the scar in the orbital cavity. An incomplete operation was performed by Dr. McDermott in November, 1906. On November 24 the mixed toxins were started and continued under Dr. Coley's direction for four months. The patient remained well for a little over three years, when she developed internal metastasis, causing death five months later.

CASE VII.—S. H., male, aged forty-two years. About ten years before patient first noticed a pigmented mole on the outer calf of the right leg, which remained about the same size until the spring of 1909, when it became irritated by his clothing, and frequently bled. Shortly after this it began to increase somewhat in size, and the patient consulted me in September, 1909. I advised an excision including a wide area of skin together with the underlying fascia, which was done by my associate, Dr. Wm. A. Downes. The tumor was examined by Dr. Wm. C. Clark (Pathologist of the Memorial Hospital) who pronounced it basal-celled epithelioma, pigmented.

The patient remained well for a little over a year, when he developed enlargement of the inguinal glands with œdema of the leg and thigh. At about the same time he began to have râles in the chest. He was treated by his physician, Dr. H. A. Griffin, and was frequently seen by Dr. Downes and myself. We believed the patient was suffering from metastases of the old trouble, and regarded the condition as hopeless. After six weeks, the chest symptoms cleared up, his general condition improved, and he was then put upon the mixed toxins of erysipelas and bacillus prodigiosus. The treatment was administered in small doses, and kept up, with occasional intervals of rest, for about a year. The swelling in the groin subsided and the œdema disappeared. It is quite possible that we were all mistaken in believing that he had metastases, and that the condition was due to some other cause. At any rate, the patient has remained well up to the present time, seven years later.

If the freedom from recurrence was due to surgery alone, it is the only case in our series apparently cured by surgery.

Pathological Report.—Specimen shows the structure of a basal-cell carcinoma of the skin. The tumor consists of one large convoluted mass of small cubical cells of the type of basal epidermal cells. In some of the cell groups there are small foci of adult squamous cells. About the main tumor mass, which measures about ½ cm. in diameter and lies well beneath the epidermis, there are a few outlying large cell groups in which the central cells are pigmented. At one point the skin is ulcerated and the adjacent

tumor structure is disordered. Here there is a large collection of heavily pigmented cells. Whether this pigment gives the hemosiderin test and is the result of hemorrhage cannot be told without a special stain. It may be a basal-cell carcinoma of the skin with secondary pigmentation from hemorrhage. It is not a typical melanoma.

Our personal series of cases shows that the disease was apparently primary in the testis in one case, recurrent in one case, in the upper jaw in one case, in the glands of the neck in five cases.

CASE VIII.—*Melanotic sarcoma apparently primary in the testis.* G. S., male, twenty-nine years old. Family history good. No mole was present in this case. The patient had always been in good health until August, 1896, when he fell from a bicycle, injuring the left testicle. About two weeks later a tumor appeared in the left testicle at the site of the injury, and grew very rapidly. First operation on January 13, 1897, by Dr. Milbank, of Albany, who removed the testicle. A recurrence quickly developed in the cord and inguinal glands. On September 30, 1897, Dr. Coley operated, removing a large lobulated mass situated in the inguinal and iliac region. Each portion was surrounded by a capsule and extended down to the aponeurosis and external oblique, but did not enter the inguinal canal. To the right, it extended beyond the median line, tipping under the lower border of the symphysis pubis, almost entering the pelvis from below. The tumor was of a dark-bluish appearance, and macroscopically a typical melanotic sarcoma. This was confirmed by microscopical examination. The patient was treated with the mixed toxins of erysipelas and bacillus prodigiosus for three weeks, without improvement. Death occurred three months later.

CASE IX.—*Neoplasms apparently primary in the cervical glands.* Dr. B., aged thirty-nine years, was referred to Dr. Coley by Dr. John A. Bodine, October 22, 1913, with the following history:

One sister died of cancer of the breast. In February, 1913, the patient first noticed a small painless tumor the size of a marble, in the region of the right submaxillary gland. This remained practically stationary in size, and was believed to be benign, until February, 1913, following a severe cold, when the tumor began to increase in size and grew rapidly. The surface became smooth and reddened, with much tenderness and pain. In a few days the swelling subsided, but became less movable than before. It was pronounced tubercular by a very experienced surgeon.

In the middle of October, he was seen by Dr. John A. Bodine, who regarded the tumor as sarcoma, and removed it. A specimen was examined by Dr. Jeffries (of the Hospital for Ruptured and Crippled), who pronounced it a round-celled sarcoma.

On October 22, 1913, the patient was referred to Dr. Coley for toxin treatment. Physical examination at that time showed a recent cicatrix in the right anterior cervical region. Just in front of the external auditory meatus was a small hard tumor, apparently rather deeply placed in the parotid gland, and rather fixed. This was apparently the seat of the disease. Under ether anæsthesia Dr. Coley removed this tumor, which was examined by Dr. James Ewing, and pronounced " a melanotic tumor, epithelial in type." The wound was then fulgurated with the Keating-Hart apparatus, and the patient then put upon the mixed toxins.

Two or three weeks later a recurrence took place, and a second operation was performed followed by a thorough fulguration and toxins. In spite of treatment, the disease recurred and slowly progressed. Examination October, 1914, showed well marked evidence of metastasis in the brain; condition hopeless. Death occurred in December, 1914.

CASE X.—Inasmuch as the following case has recently been reported in full, with microphotographs, in an article on " Primary Neoplasms of the Lymphatic Glands " (*Transactions of the American Surgical Association,* 1915) by Dr. Coley, only a brief history will be given here:

J. M. M., female, aged forty-three years. First noticed an enlargement of the submaxillary gland in July, 1911. Clinical diagnosis: Enlarged lymph-gland of submaxillary group. In January, 1912, under local anæsthesia the enlarged gland was dissected out and examined by Dr. E. S. Allen, who pronounced it a chronic adenitis, non-tuberculous. The disease recurred, and three other operations were performed, the last on September 30, 1914, at which time an incision was made through a former one on the left side of the neck and through the sternomastoid muscle. The tumor involved the internal jugular vein, so that a small portion of the latter was dissected in taking out the mass. Microscopical examination, by Dr. Graves of Louisville, Ky., showed it to be a melanotic sarcoma.

The disease promptly recurred, and on December 30, 1914, the patient was referred to Dr. Coley for the toxin treatment, which was given for two weeks; at the end of this time, the mass having considerably decreased in size, Dr. Coley removed as much of it as possible, although the operation was by no means complete. Microscopical diagnosis by Dr. Ewing: " Melanoma malignant." The toxins were immediately resumed and have been continued up to the present time. The patient has remained in good health and free from recurrence up to date—5 years since the beginning of the disease and 4 years since the first operation.

CASE XI.—*Melanotic sarcoma of the neck.* R. A., male, aged twenty-two years, was referred to Dr. Coley by Dr. Oliver C. Smith of Hartford, Conn., on February 4, 1913.

The patient had always been in good health until the summer of 1912, when he developed enlarged cervical glands. These were removed by Dr. George Bell of Hartford, and on microscopical examination pronounced round-celled sarcoma. The disease rapidly recurred, and a second operation was performed by Dr. E. S. Judd of Rochester, Minn., in October, 1912. The pathological diagnosis was cellular carcinoma. Six weeks later a nodule appeared in the left infraclavicular region, which was dissected out by Dr. Oliver C. Smith of Hartford, and pronounced by Dr. Russ (Pathologist at the Charter Oak Hospital), melanosarcoma.

The multiple tumors were many of them of a bluish color and the whole clinical picture characteristic of melanotic sarcoma.

CASE XII.—*Melanotic sarcoma of the glands of the neck.* S. S., female, aged thirty-four years, was admitted to the General Memorial Hospital on May 9, 1914, with the following history:

Thirteen years ago had first noticed a small nodule beneath the angle of the jaw, which slowly increased in size.

Physical examination showed a mass the size of a hen's egg in the right anterior triangle of the jaw, and a nodule the size of a walnut to the right of the thyroid. Lymph-nodes in both axillæ were palpable. A large mass occupied the upper half of the abdomen, extending to the umbilicus below, and continuous with the liver. An exploratory operation was performed on May 14, 1914, and glands removed from the neck and groin. These were examined by Dr. Ewing, who pronounced them melanoma.

CASE XIII.—*Melanoma apparently primary in the axillary glands.* This case has also been reported in detail in a recent paper on "Primary Neoplasms of the Lymphatic Glands" (*loc. cit.*), and will be referred to only in abstract here. Microphotographs will be found in original report.

Male, twenty-four years old, was always in good health until November, 1914, when he had an attack of influenza; a week later noticed enlargement of the axillary glands. Shortly after, other glands appeared in the cervical region. Rapid generalization of the disease set in, causing death on January 10, 1915. The whole duration of the disease was only a little over two months. A microphotograph may be found with the report of this case (*loc. cit.*).

CASE XIV.—*Melanotic sarcoma primary in the matrix of the nail* (*melanotic whitlow*). W. J. W., male, aged thirty-seven years. Family history: Three paternal uncles died of cancer;

one of sarcoma of the scapula, and two of cancer of the tongue, at the ages of fifty-five, sixty-nine, and thirty-five years, respectively.

The patient was referred to me by Dr. Wm. T. Bull, in January, 1894. Eleven years before he bruised his left thumb, but did not lose the nail nor have any further trouble until December, 1892, when the thumb was again injured by being caught in a heavy window-cord. One month later consulted the local physician, who lanced it, evacuating considerable pus. It continued to discharge freely for several weeks, sometimes as much as one-half ounce of pus being evacuated.

First operation was performed by Dr. L. L. McArthur of Chicago, on February 1, 1893, who found necrosed bone beneath the nail, which, together with a part of the nail, was removed. There was no evidence of malignancy at that time. The wound, however, failed to heal, but continued to suppurate and became very painful. On April 15, the nail became very black, and curled up; discharge ceased. The pain increased in severity and on May 15 a portion of the tissues was removed, and on microscopical examination was pronounced melanotic sarcoma. The axillary glands soon became enlarged, and on June 6 a more extensive operation was performed, consisting in removal of the thumb and axillary glands. Three glands as large as an olive were found, and pronounced sarcomatous. On October 1, several small superficial and encapsulated tumors, the size of bird-shot, were noticed on the inner surface of the arm, three inches above the radius. Shortly after another tumor was noticed on the right side of the wrist, and still another on the mammillary line of the chest wall. From that time and on, numerous small nodules appeared subcutaneously in different parts of the body. On January 14, 1894, treatment with the erysipelas toxins was begun; the injections were made subcutaneously and chiefly into the buttocks, with little effect upon the tumors present, and others continued to appear in various parts of the body. Six months later the patient developed paralysis from metastases in the dorsal spine, and died in the latter part of April, 1895.

Case XV.—*Melanotic sarcoma starting in the matrix of the nail; melanotic whitlow.* S. S., female, aged forty-two years. Family history good. Was referred to Dr. Coley in October, 1906, by Dr. Victor A. Robertson of Brooklyn, N. Y.

Six years previous an iron had fallen upon the patient's right big toe, causing loss of nail. When the new nail came in it was a very dark color. Three and one-half years later a similar accident occurred—a big iron fell upon the same toe. This time the nail came off only partly, and the new one was very dark in color. Considerable suppuration occurred about the nail, which was very

slow in healing. In April, 1906, two years after the second injury, the patient had a third injury, caused by a door falling upon her toe, which bled freely at the time. The toe looked very unhealthy, and on July 1 Dr. Robertson removed the terminal phalanx. The wound failed to heal entirely, and in a few weeks the edges became dark blue in color. Shortly after this a mass of enlarged glands appeared in the femoral region of the same side. There was a good deal of pain and some œdema of the toe and leg.

Physical examination, October 6, 1906, showed the terminal phalanx of the big toe of the right foot absent; rest of the toe enlarged two or three times the normal size, the end being occupied by a large, unhealthy ulceration of bluish color; œdema of the whole leg, ankle and foot. The right femoral region was occupied by a tumor the size of a goose egg, evidently made up of enlarged glands. They were firm in consistence, more or less fused together, making a fairly movable tumor.

Later history not traced.

Microscopical Examination.—Made by Dr. Archibald Murray (Hoagland Laboratory, Brooklyn, N. Y.), October 1, 1906: Microscopical examination of the growth removed from toe, shows it to be an alveolar, large, round-celled sarcoma. Collections of large polyhedral cells are seen which are surrounded by strands of connective tissue of varying thickness. The blood supply is fairly normal. A few giant-cells are present and cells showing karyokinetic figures are rather numerous. The skin covering the growth is normal.

CASE XVI.—*Melanotic sarcoma of the heel.* E. J., female, aged fifty-nine years. Family history good. Was referred to Dr. Coley on March 26, 1909. Personal history: When a girl, had a nail in her shoe which greatly irritated the heel. Finally a small dark spot appeared in the inner side of the left heel, which remained unchanged in size or appearance until 1901, when it began to slowly increase in size; non-ulcerating, and purplish in color. The first operation was performed by Dr. A. D. King of Alleghany, Pa. The wound did not heal for several weeks. A recurrence took place shortly after, and in 1905 the mass was drawn out with plaster. Another lump almost immediately appeared along the edge of the old scar, and was removed. Two years later another tumor developed above the ankle, in the skin. This was removed by surgical operation, and a similar tumor developed above the knee of the same leg, and was also surgically removed.

Physical examination, March 26, 1909 (six years after the first operation) showed two typical melanotic tumors on the left foot, one over the instep, about two inches in diameter, involving the skin but non-ulcerative, and the other above the ankle. Over

the inner aspect of the thigh, were two or three small subcutaneous nodules, ranging from the size of a hazel-nut to a chestnut.

Later history not traced.

CASE XVII.—*Melanotic sarcoma of the heel.* R., male, aged fifty-seven years; farmer by occupation. On May 7, 1895, one of the writers (Coley) was called in consultation to see a case, and found the following condition: A very large fungating tumor the size of two fists, very dark, almost black in color, situated in the right groin, which had first been noticed by the patient two or three months previous. A diagnosis of melanotic sarcoma was made, although no primary tumor had been observed. Careful examination, however, revealed a thickened area $1\frac{1}{2} \times 2$ inches on the ball of the foot, dark in color but non-ulcerating. The patient stated that it had started from irritation by a nail in his shoe, two years before, while plowing. It had gradually increased in size but had never ulcerated, and projected only slightly beyond the normal surface of the foot. This was believed to be the primary focus of the disease. The patient died a few weeks later. An autopsy was performed and this thickened area over the ball of the foot was removed, as well as some tissue from the groin. Diagnosis: Primary melanotic sarcoma.

This case illustrates the difficulties in making a positive diagnosis of melanotic sarcoma of the lymphatic glands.

CASE XVIII.—*Melanotic sarcoma or melanoma, apparently originating in the periosteum of the spinous process of the mid-dorsal vertebra.* Note: The clinical evidence in this case is so strongly at variance with the microscopic that we believe the diagnosis doubtful. K. E. A., female, aged fifteen years, was referred to Dr. Coley by Dr. James S. Chenoweth of Louisville, Kentucky, in August, 1915. The patient had always been well until the summer of 1913, when she struck her back against a wooden shutter. Nothing was noticed until the following April, when she felt a lump or a "bump" over the mid-dorsal spine. This remained about the same size until the Spring of 1915, when it began to grow rapidly. There was never any pain associated with it. The patient was operated upon by Dr. Chenoweth, on July 31, 1915, at which time he found a tumor involving the third spinous process of the seventh, eighth, and ninth dorsal vertebræ, extending downward some distance below. Dr. Chenoweth states that the tumor apparently originated in the tendinous structures and that the thin spinous process had been almost completely destroyed; no actual involvement of the bone was apparent. These spinous processes were removed, together with the tissues, well beyond the lateral margins of the growth.

As soon as the wound had healed, the patient was referred to Dr. Coley for treatment with the mixed toxins. She was given

¼ minim doses which later were increased up to the point of producing moderate reactions. In spite of the treatment, in early September, a well-marked evidence of a local recurrence was noticed, and the patient was admitted to the Memorial Hospital on September 7, 1915. The following day an operation was performed. Physical examination at this time showed three firmly fixed, more or less discrete tumors varying from the size of a hazel-nut to that of an English walnut, underlying the deep fascia, and attached to, if not springing from, the periosteum of the spinous process of the dorsal vertebra. A very thorough removal was made, together with the folds of the spinous process and neighboring fascia, and all of the tissue in the immediate vicinity. As soon as the patient recovered from the operation she was put upon the toxins in gradually increasing doses up to 12 minims. She was not very susceptible and had only one or two marked reactions. Up to October 11 she had had nineteen doses of the toxins and six X-ray treatments (Coolidge tube) given by Dr. Holding.

In spite of the treatment, in early October the disease began to reappear and grew very rapidly. On October 11 it was decided to perform a third and very extensive operation. With the assistance of Dr. William A. Downes an incision ten inches long was made and several tumor masses, more or less closely fused together, were removed. At this operation the tumor was found to be almost entirely on the right or opposite side from where it had been at the second operation. As in the other instances it apparently sprung from the periosteum or fascia, infiltrating the spinous process of the dorsal vertebra and involving the neighboring fascia. The base of the wound was cauterized with 20 per cent. chloride of zinc; wound closed; drainage.

The patient returned home on October 22, 1915. At this time there was already evidence of a local recurrence. The disease progressed very rapidly and in the latter part of November numbness and loss of power developed in both legs, and on December 5, there was complete paraplegia. Physical examination at this time showed a solid tumor occupying the entire right dorsal lumbar spine, extending almost across the entire back. The patient had very little pain, except in the latter stages of the disease. Death occurred on December 27, 1915.

Microscopical Reports.—First examination made at the Louisville Research Laboratory, by Dr. J. D. Allen, July 5, 1915. Examination of tumor removed from back: Macroscopically, tumor in its entirety about the size of an orange, firm, irregular and oblong in shape. Not encapsulated, infiltrating the surrounding muscular tissue, presenting a glistening appearance on cross-sections.

Microscopical sections show a mass of connective-tissue tumor cells, with very little stroma. The teased cells present long spindles, and in certain areas are grouped in giant-cells. Diagnosis: Spindle-celled sarcoma.

Examination of recurrent tumor made by Dr. James Ewing, September 9, 1915: Second of tissue reveals a tumor composed of small and medium round-cells, in diffuse or indistinct alveolar arrangement. In some places the alveolar arrangement is pronounced. Throughout the tumor many cells are distended with brownish yellow pigment. Hemorrhage is absent. The tumor is a highly anaplastic melanoma.

On account of the clinical history, Dr. Ewing stated that he was inclined to question the microscopical diagnosis, although the structure and pigment strongly indicate a true melanoma. The possibility of a primary tumor elsewhere than in the spine is not ruled out.

CASE XIX.—*Melanoma of shoulder starting in an irritated pigmented mole.* M. T., female, aged nineteen years. Family history negative. A small black mole had been observed over the upper portion of the left scapula ever since infancy. In the latter part of December, 1913, it had been greatly irritated by rubbing of the dress, which caused it to bleed. Shortly after, it began to increase in size, and was frozen off with liquid air. At this time, the patient states, it was about one inch in diameter. A local recurrence was noticed in September, 1914, and a second attempt at removal with liquid air was made. At this time a wider and deeper destruction of the tissue was made than at the first attempt. The patient remained well until June, 1915, when she noticed a lump in the neck, and little nodules appeared on both arms, back and chest. These continued to increase in size and number, until December, 1915, when she was referred to me; there were about seventy-five nodules scattered all over the body, most numerous about the face, neck and thorax. Both breasts were covered with nodules varying from ½ to 3½ cm. in diameter. Her general condition remained well during this period, and there was little if any loss of weight.

The patient had had X-ray treatment before her admission to the Memorial Hospital (in December, 1915), which was applied chiefly to the nodules over the chest. No apparent effect was observed. One nodule behind the right knee had been treated with an electric needle, with little change in condition.

Physical examination (at the time of her admission to the hospital) showed a well-developed, apparently healthy girl of nineteen years. No nodules on the head; pupils even and react to light; teeth in good condition; tongue and thorax normal; heart normal; lungs apparently normal; liver and spleen not palpable; glands not enlarged. Just to the left of the seventh cervical

vertebra, in the mid-scapular region, was an old circular scar, one inch in diameter, at the site of treatment with liquid air. Scattered over the entire body were subcutaneous nodules varying in color from white to dark purple.

The mixed toxins of erysipelas and bacillus prodigiosus were given in small doses for two weeks, with little or no effect. On January 11, 1916, under ether anæsthesia, Dr. Coley removed from both breasts a number of nodules varying in size from a cherry to that of a hickory-nut. From these, an autogenous vaccine was prepared by Dr. Richard Weil, consisting of 10 per cent. suspension of expressed tissue juice, intravenously. Five injections of this vaccine were given, producing no chill, nor increase in temperature or pulse.

In the latter part of January, 1916, the patient had severe pain in the region of the right eye; vision was impaired, pain increased in severity and vomiting took place. On February 5, an X-ray picture taken showed enlarged glands in the right lung, which, according to Dr. Holding, were probably metastases. February 10, severe pain and vomiting continued, with irregular temperature and great loss of weight. Her symptoms pointed to brain involvement. Her general condition failed very rapidly. She returned home and died shortly afterward.

Microscopical Examination (by Dr. Ewing).—Small section of fibrous tissue is infiltrated by large typical alveolar, diffuse and perivascular melanoma free from pigment. The cells are large, clear and polyhedral.

In the following case several pigmented moles were present in various parts of the body, but there was no evidence of their having had any connection with the disease.

CASE XX.—*Melanotic sarcoma primary in the axillary glands.* J. W., male, aged thirty-eight years, was admitted to the General Memorial Hospital on May 6, 1914, with the following history:

Seven months prior to his admission he had noticed a small lump in the right axilla, about the size of a hazel-nut, which grew until it had reached the size of an egg in six months. First operation was performed at the Roosevelt Hospital, on April 20, 1914. On microscopical examination, the disease was pronounced perithelial sarcoma. Shortly after he began to have pain in various parts of the body, and several small lumps appeared in the skin, on the chest, back, arms, and thighs. Patient lost thirty pounds in weight.

Physical examination (May, 1914) showed numerous small tumors varying in size from a hazel-nut to an almond. In May,

1914, I removed a small tumor from the arm, which was examined by Dr. Ewing, and pronounced melanoma.

Toxin treatment was given for nine days, with no improvement, and then discontinued. The patient died on June 11, 1914. Fortunately it was possible to obtain an autopsy in this case, which showed many tumors in the liver, adrenals, spleen, vertebræ, and testes.

Microscopical Examination (by Dr. James Ewing).—Section of a malignant tumor infiltrating fat tissue. It has the general appearance of melanoma without pigmentation. The cells are large polyhedral, arranged in characteristic alveoli, surrounded by fine vascular stroma. No definite pigmentation.

The following case is fairly typical of the history of the beginning and end of a melanotic cancer. We have, first, the remote causative factor, *i.e.*, a pigmented mole; second, irritation of the mole by application of some form of caustic; subsequently (but unfortunately too late) the surgical excision, followed by generalization of the disease and death.

Case XXI.—G. J. G., male, aged forty-three years, was referred to Dr. Coley on February 18, 1915, with the following history: Eighteen months before patient noticed a dark-colored mole, the size of a five-cent piece, and of uncertain duration, on the left shoulder-blade. The mole began to show a slight ulceration, and formed a pimple in the centre. This was cauterized with nitrate of silver for three months, during which time it had increased in size, and became harder in consistence. Six months later it had reached the size of a silver quarter, and was excised by his local physician. A specimen was not examined. A local recurrence took place and was again promptly operated upon in August 5, 1914. Microscopical diagnosis: small round-celled sarcoma (no mention of "pigment" was made). A third operation was performed in November, 1914, followed by a course of X-ray treatment; two treatments a week were given until he had received twelve. In spite of treatment, patient continued to fail and died in 3 months.

Microscopical Examination (by Dr. James Ewing).—Section is of an irregular mass of fibrous tissue infiltrated by a malignant tumor which has the general appearance of non-pigmented melanoma. The cells are large, clear, polyhedral and spindle, arranged in alveoli or about blood-vessels.

We have presented this clinical study of one of the rarer types of cancer in the hope that it might lead to earlier diagnoses and earlier

FIG. 1.—Melanoma starting in very large pigmented mole (multiple) on face. Generalization of disease.

FIG. 2.—Side view of same case as Fig. 1.

FIG. 3.—Melanoma of eye in child one and one-half years old (youngest of series).

FIG. 4.—Melanoma of neck, starting in pigmented mole.

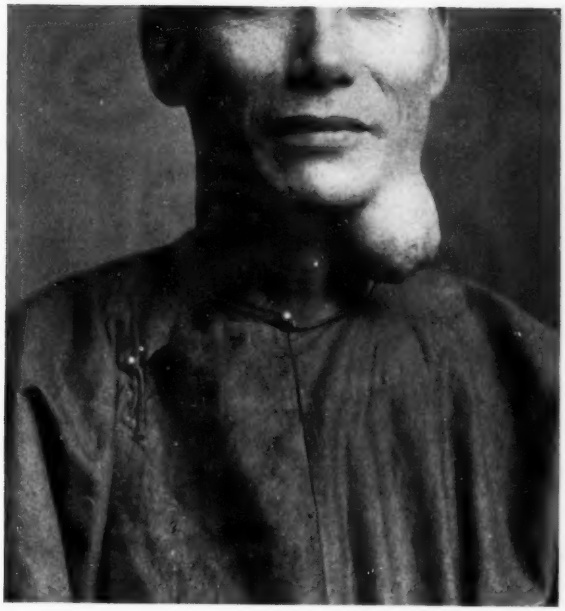


FIG. 5.—Melanotic carcinoma, apparently starting in gland of neck (see Case 57 in table).

FIG. 6.—Melanotic sarcoma of thigh. The wound as it appeared just before death of patient (in Case 32 in table).

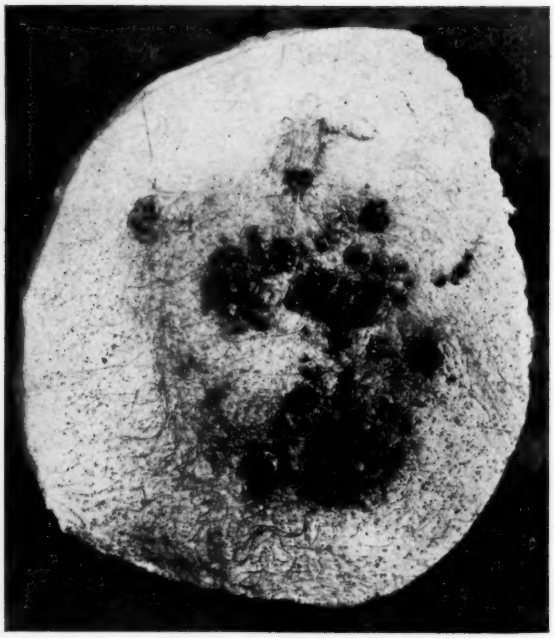


FIG. 7.—Melanotic sarcoma of thigh; primary tumor (see Case 31 in table).

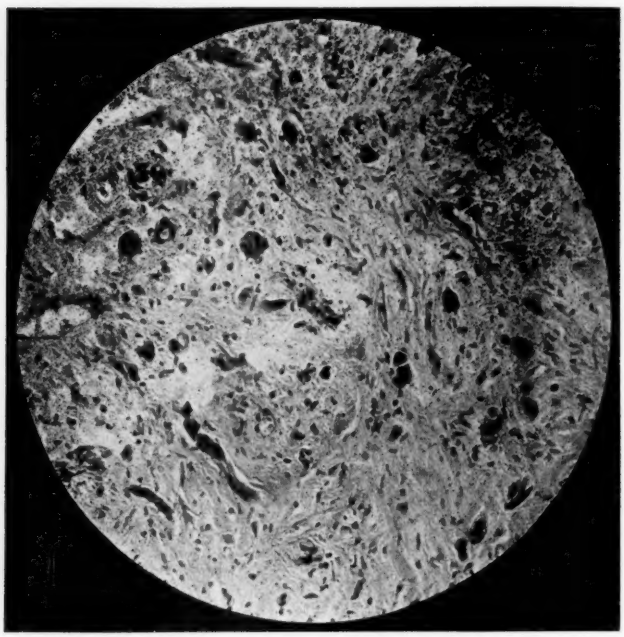


FIG. 8.—Primary in the neck.

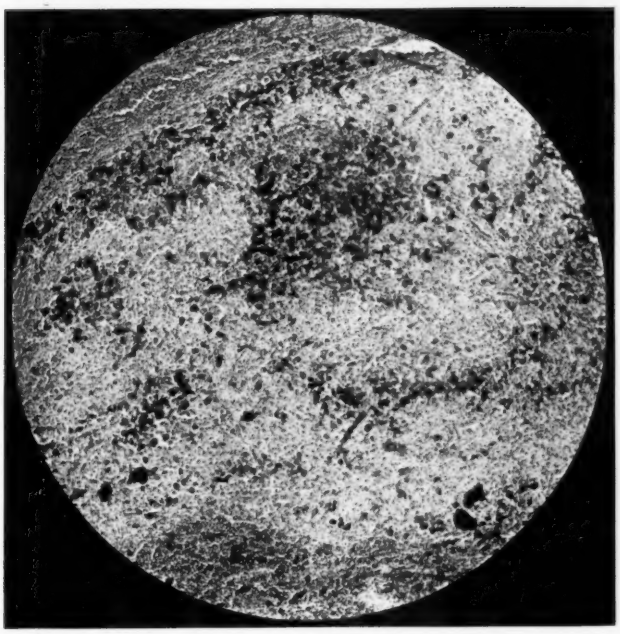


FIG. 9.—Primary in the scapula.

FIG. 10.—Primary in nasal cavity.

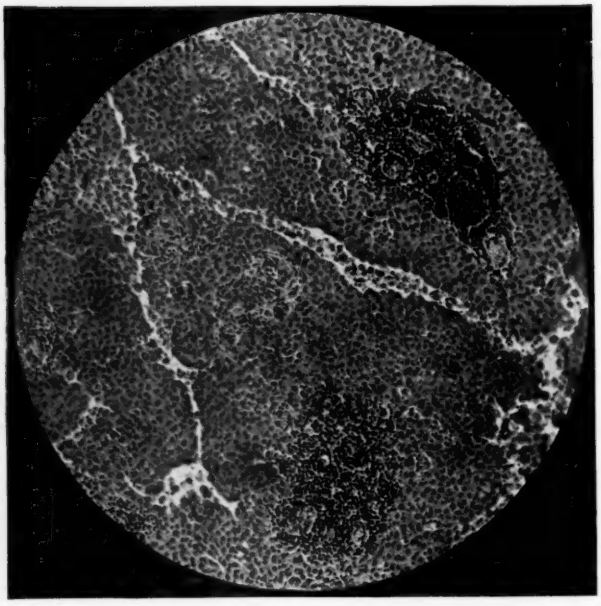


FIG. 11.—See Case 55 in table.

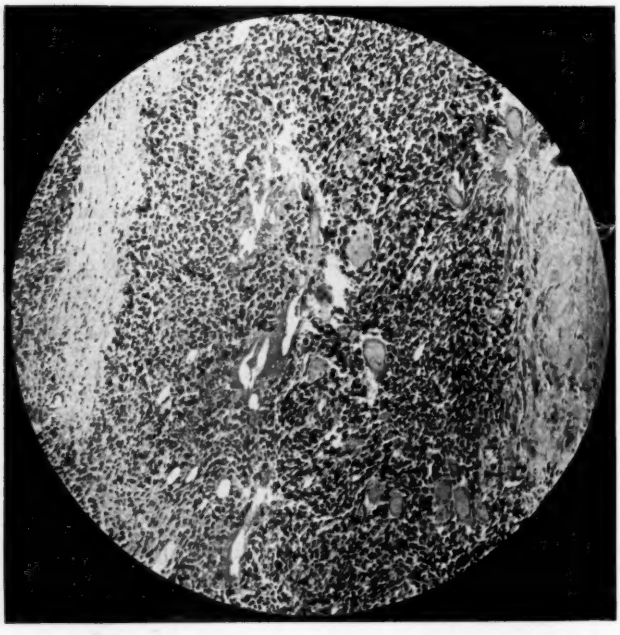


FIG. 12.—Melanotic sarcoma of scapula (see Case 16 in table).

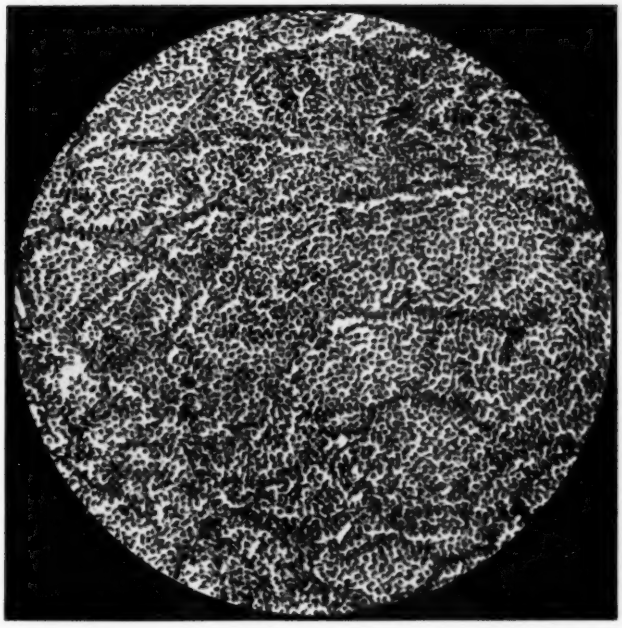


FIG. 13.—Melanotic sarcoma (see Case 2 in table).

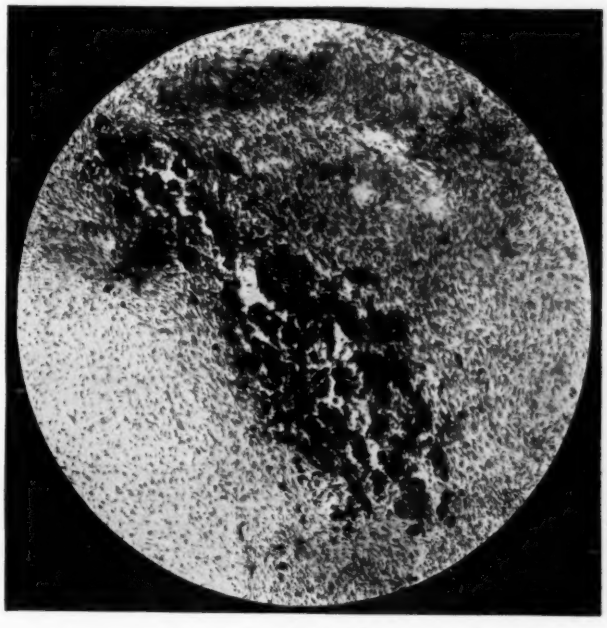


FIG. 14.—Case I.

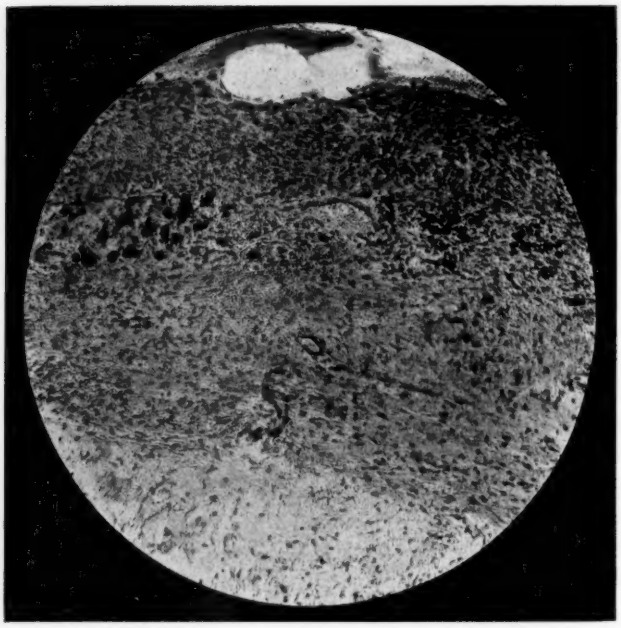


FIG. 15.—Case I.

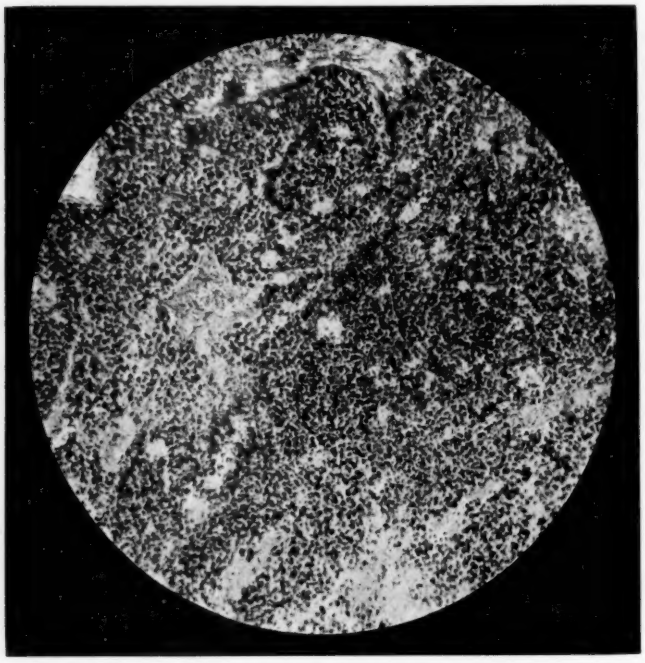


FIG. 16.—Case IV

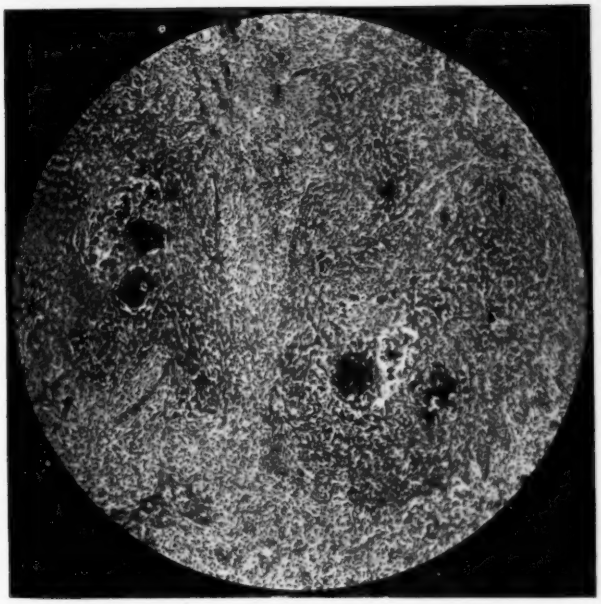


FIG. 17.—Case VII.

FIG. 18.—Case VII. Melanoma of calf of leg, starting in pigmented mole; irritated by clothing. Patient well six years after operation.

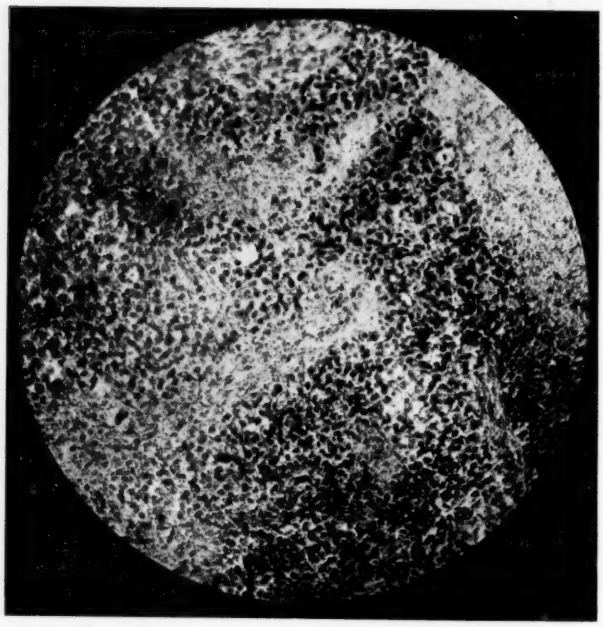


FIG. 19.—Case XI.

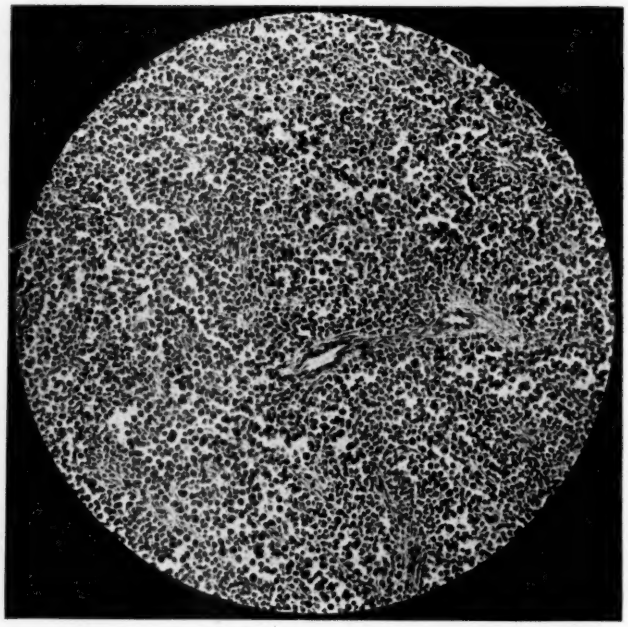


FIG. 20.—Case XVIII.

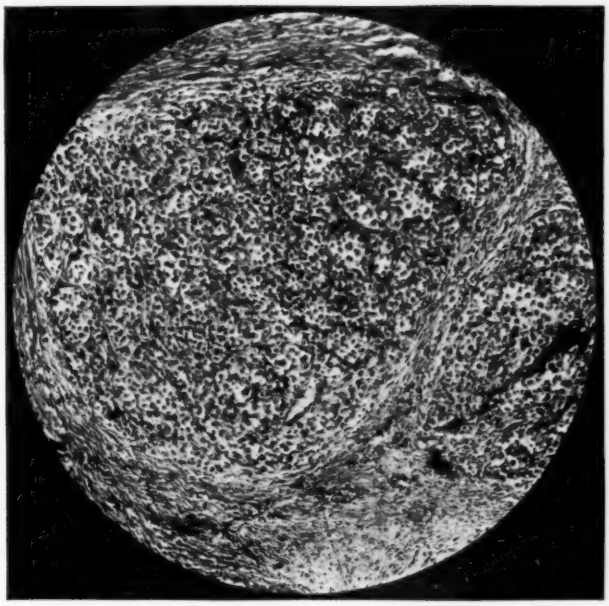


FIG. 21.—Case XIX.

FIG. 22.—Case XIX. Melanoma primary in pigmented mole of neck, following removal with liquid air.

FIG. 23.—Case XIX. Front view of same case as Fig. 22.

FIG. 24.—Melanoma starting in ball of foot; metastases in inguinal, femoral and iliac glands.

FIG. 25.—Case XXI. Primary melanoma of shoulder.

surgical treatment. The chief hope of reducing the mortality of this extremely fatal type of neoplasm must rest with prophylactic treatment, *i.e.*, the surgical removal of all pigmented moles, as soon as observed and particularly in all cases in which the anatomical locality renders them liable to irritation or to external injury. If this rule is rigidly followed we believe the number of cases will be markedly diminished.

Essential points in 91 cases as to sex, age, presence of mole, site of original tumor:

Males	51
Females	40

Age average in 82 cases (not stated in 8 cases) 36.8 years.

Mole present in 36 cases.

Site of primary lesion:

Not given	1	Back	4
Eye	11	Leg	5
Axilla *	4	Thigh	5
Back	5	Testis *	1
Neck	10	Foot	3
Shoulder	4	Abdominal wall	1
Behind ear	5	Toe	5
Cheek	2	Cervical glands *	2
Chest	3	Scalp	1
Breast	1	Heel	4
Ankle	5	Face	2
Arm	2	Pubes	1
Rectum	1		
Groin	3		91

Cases of irritation of a mole = 17.

Removal of a mole in 14 cases, by surgery, electricity and caustics.

* In these cases no other primary focus could be found.

PERSONAL CASES.

No.	Name.	Sex.	Age	Date.	Locality primary.	Etiology.	Histology, microscopic examination	Glands enlarged.	General metastases.	Treatment.	Result immediate.	Result final.	Total duration of life after first noticed.
1	J. W. . . .	M	38	1914	Right axilla	.....	Perithelial sarcoma; melanocarcinoma round-celled, varying to spindle-celled with pigments	No	Subcutaneous liver, adrenals, spleen, vertebral tissues	First operation, Roosevelt Hospital, Apr. 20, 1914; second operation, May 8, 1914. Toxins, May 8 to 17	No improvement	Died June 11, 1914	Oct., 1913–June 11, 1914.
2	N. K. . .	M	21	1909	Between eyeball and eyelid	.....	Non-pigmented melanoma	Yes, throughout body	Subcutaneous lymph nodes, liver nodules in skin	Excision 1909, 1910, 1911; enucleation of eye, Apr., 1913. Tumor on abdominal wall removed June, 2, 1914. Vaccine treatment June and July, 1914 no result	.....	.....	1908 to 1915.
3	Dr. T. G. W. .	M	37	1911	Lower part of back	Removal of mole by carbolic acid	Mixed-celled sarcoma with a preponderance of round cells	Yes	.....	Operations 1911, Dec. 1914 Toxins Dec., 1914, to date	Increase in induration in axilla	.....	1911.
4	Mrs. R. . .	F	38	1894	Neck	Congenital mole	.....	Yes	.....	Operation Apr., 1894; three recurrences	No improvement	.....	Nov., 1893.
5	R. H. . . .	M	53	1900	Eye	Irritation	.....	.....	.....	Eye removed Apr. 15, 1900 Recurrence July, 1900	.....	.....	12 years.
6	S. J. . . .	M	63	1895	Eyelid	.....	Typical melanosarcoma	Yes	.....	1st oper., Sept., 1894; 2d oper. Oct., 1894; 3d oper. Apr., 1895; 4th oper. July 1895. Toxins Aug., 1895, Oct., 1895, 4th oper.	Local recurrences and glandular involvement	Died	May, 1894 to Oct., 1895.
7	G. . . .	M	40	1906	Eye	.....	Melanosarcoma	No	.....	Eye removed, 1900	Mass in right side of abdomen	.....	1900 to 1906.
8	J. W. B. . .	M	..	1913	Left eye	.....	.....	Yes	Multiple subcutaneous	Eye removed, 1907. Toxins 4 weeks, 1913	Recurrences, 1913	No improvement	1907 to 1913.
9	Mrs. C. . .	F	70	1911	Eye	.....	Spindle and round-celled arranged in meshes with more or less intimate relation between cells and a basement substance penetrating between cells. Alveolar melanosarcoma	.....	Tongue and subcutaneous	First operation on eye, 1908	Recurrence 3 years after on tongue, then subcutaneously	No improvement	1908 to 1911.
10	Mr. E. B. B. .	F	60	..	Eye	.....	.....	.....	.....	Enucleation of eye, 1888			

11	J. T. C. B. .	M	40	..	Eye	.....	.....	.....	.....	Operation on eye, Feb., 1911			
12	I. M. . . .	M	23	1908	Axilla	.....	Melanoma round- and spindle-celled	Yes	Lungs	Operation, Sept., 1908, followed by toxins	No improvement	Rapid decline	
13	M. W. . .	F	50	1897	Below fold of axilla	.....	Melanotic alveolar sarcoma	Yes	.....	.....	.....	Death	7 months.
14	C. P. . . .	F	60	1913	Right shoulder	.....	Large round-celled sarcoma	Yes	.....	Removal of growth on shoulder Dec., 1912; 2d oper. Feb., 1913, toxins until June	Recurrence in scar; removed O. K., Feb. 26, 1914	Death	
15	J. A. F. . .	M	38	1913	Mole behind ear	.....	.....	Yes	.....	First oper. (?); 2d oper. Jan., 1913	Local recurrence after both operations		
16	G. G. . . .	M	43	1914	Left scapula	Ulceration of mole	Small round-celled sarcoma	Yes	.....	1st oper. Feb., 1914; 2d oper. Oct., 1914	Recurrence at site of operations and extension		
17	R. F. . . .	F	35	1906	Mole on cheek	Irritation of mole by needle and ligation	.....	Yes	Metastases in spine	1st oper. Jan., 1902; 2d oper. Jan., 1904	Recurrence in scar	Steady decline	4 years.
18	N. F. H. . .	M	45	1905	Mole just below ear	Irritation by caustics	.....	Yes	Metastases in spine	Ligation of carotid	Steady increase in size of tumor	Steady decline in condition	5 years.
19	Dr. E. C. F. .	M	38	1911	Mole in scalp behind ear	Removal	Melanotic sarcoma	.....	Subcutaneous metastases	1st oper. June, 1910; 2d oper. Feb., 1911; toxins X-rays	Extension of growth	Metastases	18 months.
20	F. C. . . .	M	25	1895	Right side of chest	.....	Typical sarcoma with pigment round-, oval- and spindle-shaped cells	Yes	.....	Operation July, 1895	Rapid recurrence; toxins	Increase in size of tumor; decline in condition	2½ years.
21	Mrs. H. E. F.	F	26	1909	Lower chest	.....	Kaposi, pigmented hemorrhagic sarcoma	Yes	.....	Operation Dec., 1909			
22	M. F. . .	F	44	1898	Breast	.....	.....	No	.....	Both breasts removed July 1897	Rapid decline	.....	18 months.
23	Mrs. N. . .	F	37	1902	Ankle	Irritation of mole	Round- and spindle-celled sarcoma; much pigment in cells and connective tissue	Femoral and iliac	.....	1907, oper. on ankle; same year oper. on femoral glands. 3 more oper. X-rays	Rapid recurrence and increase in rapidity of growths	Decline	6 years.
24	W. H. C. .	M	47	1900	Skin of arm	Injury	.....	Axillary	In abdomen	Operation on arm and axilla			
25	Mrs. B. H. .	F	49	1909	Rectum	Not given; has had hemorrhoids	Melanotic sarcoma	Abdominal	.....	Oper. on rectum July, 1907	Recurrence locally	Increase in size	Over 3 years.

PERSONAL CASES.—Continued.

No.	Name.	Sex.	Age.	Date.	Locality primary	Etiology.	Histology, microscopicexamination	Glands enlarged.	General metastases.	Treatment.	Result immediate.	Result final.	Total duration of life after first noticed.
26	Miss A. W. .	F	33	1903	Ankle	Irritation of mole	.....	Femoral	.....	Oper. ankle Aug., 1902; recurrence; removed Oct., 1903	Increase in size of femoral tumor	Died May, 1904	13 months.
27	E. S. . . .	M	51	1906	Groin	Irritation of mole	.....	Femoral and inguinal	.....	Oper. July, 1905; local recurrence in Sept.	Loss of weight Œdema of leg		
28	H. . . .	M	20	1912	Back	.....	Round-celled sarcoma	Inguinal	.....	1st oper. 1910; 2d oper., 1911	Local recurrences and in groin		
29	F. H. W. . .	M	..	..	Femoral region	.....	Mixed-celled sarcoma with pigmentation in places	Yes	.....	.....	.....	.....	1 month.
30	J. C. . . .	M	29	1900	Leg above ankle	.....	.....	Yes: in groin	.....	Oper. May, 1899; recurrence in July; oper. in Aug., 1900; recurrence in Sept.	Local recurrence after third oper.		
31	J. S. W. . .	M	55	1901	Thigh just above knee	Irritation from clothing	Typical melanotic sarcoma	Yes; inguinal	.....	Oper. July, 1901; local recurrence. Hip joint amputation Oct., 1901	Recurrence in abdominal wall and iliac glands; steady deterioration	Died Feb., 1902	
32	W. D. . .	M	19	1897	Inner aspect of thigh	Ligature of mole	Melanosarcoma	Inguinal femoral iliac	Glands and surface of body	1st oper. Dec., 1895; 2d oper. Apr., 1897	Local recurrence in abdominal glands	Increasing weakness and emaciation	4 years and 4 months.
33	G. S. . . .	M	29	1897	Testis	Injury by fall from bicycle	Melanotic sarcoma	Inguinal	.....	1st oper. Jan., 1897; 2d oper. Apr., 1897; 3d oper. July, 1897. Toxins 3 weeks with no avail	Recurrence in inguinal region	Died Jan., 1898	1 year.
34	Mrs. J. E. C.	F	23	1906	Thigh above knee	Tied off mole with thread	Melanotic sarcoma	Inguinal femoral	Femoral, inguinal, and iliac glands	Extensive operation Nov., 1905	Rapid recurrence	Died, 1907	2 years 4 months.
35	L. A. . . .	F	32	1909	Outer tibial region	Removal of mole by electricity	.....	Inguinal	.....	1st oper. 1904; 2d oper., 1906; 3d oper., 1908; 4th oper. Nov., 1908	Recurrence after each oper.	.....	5 years.
36	A. . . .	M	40	1909	Sole of foot	Treatment of wart by chiropodist	.....	Inguinal	.....	Oper. Feb., 1909, on sole and glands	Recurrence in glands	.....	9 months.
37	Miss X. . .	F	..	1910	Outer aspect of ilium	Ulceration of mole	.....	.....	.....	.....	.....	.....	4 years.
38	Miss H. . .	F	30	1897	Little toe	.....	Typical melanotic sarcoma; spindle-shaped cells	Inguinal	.....	Oper. Nov., 1897	Inoperable growths in groin and abdomen		

39	Miss A. . .	F	17	1912	Upper and outer aspect of thigh	Struck several times	Melanotic sarcoma	No	Oper. Apr., 1912. Toxins for 2 years (100 doses)	No recurrence	.....	Well, March, 1915	
40	R. A. . . .	M	22	1913	Cervical glands	.....	Cellular carcinoma and melanosarcoma	Yes	.....	1st oper. July, 1912; 2d oper. Oct., 1912	Rapid recurrence after each oper.; steady deterioration	Died March 15, 1913	About 1 year
41	R. . . .	M	32	1894	Scalp	Mole	Melanotic sarcoma; round-celled	Yes	Subcutaneous liver	None	Rapid deterioration	Died	
42	E. I. S. . .	M	62	1901	Eye	.....	.....	.....	.....	Removal of eye	.....	.....	3 years.
43	S. S. . . .	F	42	1906	Toe	Several injuries by iron objects falling on it	Alveolar large round-celled sarcoma	Yes	.....	1st oper. Nov., 1903; 2d oper. July, 1905	Failure to heal	.....	6 years +.
44	H. F. . . .	M	47	1908	Heel	Irritation by tight shoes	.....	Yes	.....	1st oper., 1905; 1908 amputation of leg	Rapid recurrences	.....	12 years +.
45	E. J. . . .	F	59	1909	Heel	Irritation by shoe	.....	.....	Subcutaneous	1st oper., 1903; 2d oper., 1905	Recurrences; loss of eyesight and strength	Dissemination	6 years +.
46	C. M. . .	M	21	1905	Forearm	.....	.....	Axillary	Subcutaneous chiefly in upper extremity, chest and back	1st oper., 1905	.....	Dissemination	7 months.
47	A. W. L. .	M	35	1898	Cheek	.....	.....	Groin	.....	1st oper. Feb., 1895; 2d oper. Oct., 1897			
48	G. R. C. .	M	30	1904	Thigh near knee	Burn	Spindle-celled sarcoma	.....	.....	1st oper June, 1904; toxins 3 years	No recurrence	Well when last heard from	
49	J. L. . . .	M	33	1908	Ankle	Cauterization of mole	Melanotic sarcoma; melanotic carcinoma	Femoral	.....	1st oper. on ankle, April, 1907; 2d oper. femoral glands, Apr., 1908	Recurrence in glands	.....	14 months.
50	J. Q. . . .	F	60	1899	Ankle	Excision of wart	.....	Femoral	.....	Several attempts at removal of mole by caustics	Local recurrences and in femoral glands	.....	5 years +.
51	E. E. . . .	M	31	1910	Calf of leg	.....	.....	Femoral and inguinal	.....	1st oper. Jan., 1909; 2d oper. May, 1909; toxins	Local recurrences in glands	.....	3 years +.
52	T. S. S. . .	M	43	1912	Outer side of foot	.....	Melanotic sarcoma	.....	Upper thigh and in prostate	1st oper., 1910	Recurrence locally, and in thigh	.....	2 years +.
53	M. S. . . .	M	20	1909	Ankle	.....	Melanotic epithelioma	Inguinal femoral	.....	1st oper. Feb., 1909; toxins	Recurrence locally, at knee and glands	Well, Aug., 1909; no recurrence	
54	D. B. . . .	M	39	1912	Neck	.....	Round-celled sarcoma; melanotic tumor; epithelial	Neck	Neck and prostates	Oct., 1912	Recurrence	Steady deterioration	About 2 years.

PERSONAL CASES.—Continued.

No.	Name.	Sex.	Age.	Date.	Locality primary.	Etiology.	Histology, microscopicexamination	Glands enlarged.	General metastases.	Treatment.	Result immediate.	Result final.	Total duration of life after first noticed.
55	J. M. F. . .	M	..	1914	Back	Irritation by clothing	Melanotic carcinoma	Axillary both sides	.....	1st oper. Mar., 1914; 2d oper. June, 1914; 3d oper. Aug., 1914; on glands	Local recurrences		
56	P. C. . . .	M	28	1895	Neck	Mole tied off	Melanotic sarcoma; round-celled inclining to spindle	Yes	.....	1st oper. July, 1891; 2d oper. May, 1895; toxins	Recurrence; no effect	.....	Over 4 years.
57	L. G. . . .	M	..	1889	Neck	.....	Round and spindle cells; mucoid tissue and pigment	Yes	.....	Removal, 1885; removal in May, 1889	Recurrence not known		
58	F. M. . .	M	44	1894	Neck	.....	Typical melanotic sarcoma; round-celled	Yes	.....	Oper. Jan., 1894; oper. June, 1894	Recurrences	Steady deterioration in general condition	
59	Mrs. B. . .	F	45	1895	Neck	Mole	Melanotic sarcoma; round-celled	Yes	.....	Oper. Apr., 1895; oper. Sept., 1895; toxins 5 weeks	General sarcomatosis	Died	10 months.
60	Mrs. M. P. .	F	46	1907	Neck	Mole	.....	Yes	.....	Oper. June, 1906	Recurrence	.....	Over a year.
61	J. S. D. . .	M	58	1912	Neck	Mole	.....	.....	.....	1st oper. Dec., 1912	Recurrence	.....	1 year 3 months +.
62	M. E. . .	F	32	1914	Axilla	.....	Hemangio-sarcoma melanoma	Yes	Over lower end of radius	1st oper. Apr., 1913; toxins and X-rays	3 recurrences	O.K. Feb., 1914	
63	C. H. T. . .	M	52	1903	Pectoral region	Mole; none found	Mixed-celled sarcoma with chromatin	Axillary	.....	1st oper. Feb., 1902. Axilla cleaned out Feb., 1913; toxins after	3 recurrences	.....	1 year +.
64	Dr. E. R. D. .	M	53	1912	Second toe	Ulceration of nevus, 1906	Pigmented sarcoma; oval and round epithelial-like cells	Groin	Right hemisphere of brain	Amputation of toe, 1908; glands removed, 1912; toxins 1 month	Recurrence in groin; recurrence tumor disappeared under toxins	Died, Oct., 1912	6 years.
65	Mrs. J. A. F.	F	51	1915	Temporal region	Mole is irritated by combing hair	.....	Neck	None	Removal of mole; toxins	Recurrence in cervical glands	Still under treatment	9 months +.
66	W. B. . .	M	33	1912	Calf of leg	None known	Sarcoma epithelioma	Groin	None	1st oper. June, 1911; toxins May, 1912	Recurrence local and in glands; reduction in size of tumor	.....	2 years +.
67	A. H. M. .	F	56	1911	Heel	Trauma	Melanotic sarcoma	None	None	Oper. May, 1911	Local recurrence	Well, 1909	

68	S. M. . . .	F	43	1914	Neck	?	Perivascular and diffuse melanoma large clear cells and scanty pigmented area	Neck	None	Oper. Oct., 1911; oper. Jan., 1912; oper., 1913; oper. Sept., 1914; oper. Jan., 1915; toxins	Immediate local recurrence		
69	K. A. . . .	F	15	1915	Back	?	Melanoma	None	.....	Oper. July, 1915; oper. Sept., 1915; oper. Oct., 1915; toxins 19 doses; X-ray 6 times	Local recurrences	Death Dec., 1915	5 months.
70	M. F. . . .	F	56	1914	Groin	?	Malignant epithelial tumor; cells arranged in small alveoli. Some areas show masses of polyhedral cells; no pigment melanoma suggested	Cervical inguinal axillary	Glands and subcutaneous nodules	Oper. Dec., 1914; oper. June, 1915	Local recurrences; later general	Died Nov., 1915	1 year 3 months.
71	M. P. . . .	F	53	1914	Ear	?	.....	Cervical	None	Oper. 1905, on ear; oper. Jan., 1914	Recurrence 6 mos. after last oper.	Died, Apr., 1916	11 years.
72	E. B. . . .	F	59	1913	Toe	Wart	Polyhedral cells in alveolar arrangement; red and yellow pigment present	Groin	None	Toe oper. in 1913; X-ray	Recurrence in groin 3 mos. after	.....	2 years.
73	M. O'C. . .	F	38	1915	Pubes	Mole ?	Melanosarcoma	Inguinal	None	Oper. May, 1915	Local recurrence	Died	11 months.
74	C. McG. . .	F	50	1914	Behind ear	Irritation by collar	Mixed tumor of parotid	Cervical	None	Removal of mole by paste oper. Dec., 1914; X-ray	Local recurrences improved	.....	Over a year.
75	C. R. . . .	F	48	1914	Toe	Irritation of mole by shoe	Granulation tissue with many large spindle cells, probably spindle-celled sarcoma	.....	.....	Removal Oct., 1914	Recurred locally	Improved	3 years +.
76	V.	M	61	1915	Toe	Irritation of mole by shoe	.....	Inguinal femoral popliteal	Not known	Removal Apr., 1915 and Oct., 1915; X-ray; radium	Recurred around scars	Improved	1½ years +.
77	T.	F	18	1915	Back	Mole removed by liquid air	.....	Yes	.....	Liquid air, X-ray with no effect; oper.; autogenous vaccine	Recurrence; loss of weight, pain	No improvement	2 years.
78	H. . . .	M	47	1909	Calf of leg	Irritation of mole by clothing	Basal celled carcinoma; pigmented	Inguinal	.....	Oper.; toxins	Improvement; disappearance of tumor	Patient well 7 years later	
79	H. . . .	M	60	1915	Eye	.....	Melanotic sarcoma	Mediastinal	.....	Oper.; remained well for 3 yrs.; toxins no effect	Recurrence shortly after	Death in a few months	
80	K. . . .	M	57	1895	Heel	Irritation of mole	Melanotic sarcoma	Groin	.....	.....	.....	Death	2 years.
81	S.	M	50	1916	Foot	Irritation of mole by shoe	Melanotic sarcoma	Iliac and femoral	.....	2 operations; toxins	Recurrence	Still under treatment.	

FOLLOWING 14 CASES TREATED BY OTHER MEN.

No.	Doctor's name.	Sex.	Age.	Date.	Locality primary	Etiology.	Histology, microscopic examination	Glands enlarged.	General metastases.	Treatment.	Result immediate.	Result final.	Total duration of life after first noticed.
1	Greenwood's case, Leeds, England	M	Adult	1911	Neck	.....	Melanotic sarcoma	.....	.....	Incomplete oper. Feb. 1911; 36 injections, toxins	Recurrence; reduction in size of tumor	Cured. O.K. May, 1916	
2	L. R. Dawson's case . .	..	...	1903	Temporal region	.....	Melanotic sarcoma	.....	Subcutaneous all over body	Removal, 1902	Recurrence	Deterioration	14 months.
3	Kamerer's case . .	..	...	1897	Shoulder	.....	Melanotic sarcoma	Axilla	Loin	1st oper. July, 1896; 2 others later	Recurrences	Rapid deterioration	1 year +.
4	T. S. McDermott's case . .	F	45	1904	Retina	.....	Melanotic sarcoma	.....	Lumbar region	Dec., 1904 enucleation of eye. Toxins Nov., 1905; Mar., 1907	Recurrence in orbit	Died, June, 1910	6 years.
5	Van Duyn's case . .	F	...	1897	.....	.....	Melanotic sarcoma	.....	.....	Oper. 1897; 20 to 30 operations	Recurrences	Died Dec., 1899	2 years +.
6	S. S. . . .	F	34	..	Neck	.....	Melanosarcoma	Both axillæ	Neck, axilla, abdomen, liver	No oper.; specimen removed	General condition progressively worse	Died, June, 1914	3 months.
7	M. S. . . .	F	64	..	Heel	Trauma	Melanoma	Groin iliac	Groin and abdomen	Opers., 1910, 1911, 1913	Local recurrences; glands involved after 1913	Died Apr., 1915	7 years.
8	M. F. . .	M	50	..	Outer canthus of eye	.....	Melanotic sarcoma	Glands behind and in front of ear	.....	1st removal May, 1914, electricity; recurrence and glandular involvement	Recurrence and glandular involvement		
9	V. C. . . .	F	37	..	Cheek	.....	Melanosarcoma	Neck	.....	Radium and oper.	Recurrence	.....	4 years +.
10	H. N. Lyon's case . .	F	23	1913	Fibula below knee	Mole	Mixed-celled sarcoma with pigment	Groin and iliac	.....	1st removal Feb., 1913 Toxins Jan. 20, 1915	Prompt local recurrence with metastasis	No improvement	2 years +.
11	H. F. Hull's case . .	F	23	1914	Leg	Traumatism to mole	Lymphosarcoma mixed-celled type	Groin epitrochlears axillary supraclavicular	.....	Removal by cautery Feb., 1913; toxins	Local and general recurrences	No improvement	About 2 years.
12	S. R. Fowler's case . .	M	Adult	?	Jaw	.....	Melanotic	.....	.....	Toxins	Disappearance	Recurrence 2 years later	
13	H. Lilienthal's case . .	F	20	1912	Superior maxilla	.....	Spindle-celled osteosarcoma	.....	.....	Excision left superior maxilla incomplete removal of tumor; toxins	Entire disappearance	Still well	
14	F. E. Bunt's case . .	M	51	1915	Toe	.....	Melanosarcoma	.....	Cerebral	3 operations; X-ray; toxins	Entire disappearance. Well for 2 yrs.	Died Dec., 1915	3 years.

BIBLIOGRAPHY

Lebert: Anatomie pathologique, 1855–1857, t.i.
Virchow: Pathologie des Tumers, t. 11.
Leyton: Lancet, March 4, 1916.
Busch: Berl. klin. Wchnschr., 1880, No. 16.
Boulay: Arch. générales de médecine, July, 1888.
Nepveu: Trans. Société de biologie, 1874.
Dietrich: Langenbeck's Arch., 1887.
Bard: De la naturo parasitaire de la melaniques, Lyon médical, 1885, p. 407.
Peulevé: Contribution a letude de la mélanose généralisée, Thése de Paris, 1886.
Ribbert: Über das Melanosarkom. Beitr. z. path. Anat. u. z. allgem. Pathologie, Bd. 21, 1897.
Unna: Das Pigment der Haut. Monatshefte f. prakt. dermatol., Bd. 8, 1889.
Ebermann: Deut. Zeit. f. Chir., vol. xliii, Heft iii, S. 498.
Eve: Lecture on Melanoma. London Practitioner, February, 1903.
Handley: Hunterian Lectures on Melanoma. Lancet, 1907, vol. xxvii, p. 996.
Chalier and Bonnet: Revue de chir., December, 1912, June, 1913.
Smith, Erwin F.: Am. Jour. Cancer Research, April, 1916, and Science, June 23, 1916.
Borst: Die Lehren. d. Geschwol.
Leo: Society de Chir. de Paris, 1912, 1007.
Wieting and Hamdi: Beitr. z. Path. Anatomie, 107, vol. xlii.
Bechaux: Thése de Paris, 1908-1909.
Johnston: Journal Cutaneous Diseases, 1905.

OBSERVATIONS ON THE DIAGNOSIS AND TREATMENT OF TRIFACIAL NEURALGIA *

By E. H. Beckman, M.D.
of Rochester, Minn.

These conclusions are based on the results of treatment in 177 cases of trifacial neuralgia which have come under our observation.

Diagnosis.—Trifacial neuralgia is not often confused with any other disease by those who have seen a number of cases. It is a disease that has a distinct entity. In our series, males and females were about equally affected (male 96, female 81). A great many cases in which there was pain about the head and face due to sinus disease, disease of the nose and infection about the teeth or jaw are confused by the average practitioner with facial neuralgia and referred to the surgeons or neurologists as such. All cases of this nature have been excluded from this series.

The term tic douloureux is a misnomer, since there is no true spasm of the muscle associated with the pain. This muscular spasm occurs in only a small percentage of the cases, and is a voluntary or involuntary jerking of the muscles resulting from the sudden severe pain; the patient is startled by the lightning-like pain and the muscles of the face are contracted in consequence. Many patients attempt in every way possible to immobilize the muscles of the face for fear the attack may continue. Consequently, they refuse to speak in answer to questions, refrain from taking food or drink except when necessity demands it, and delay bathing the face as long as possible. The pain is always severe and comes in a short, sharp attack, like a shock of electricity. If the attack continues for a half minute or longer, it will be found on close questioning that the pain is not continuous, but is made up of a series of short, severe attacks interrupted by brief intervals. We have not seen cases in which the pain was of any other character.

A continuous aching pain or pain that throbs with the pulse certainly is not trifacial neuralgia. From our observations, and as Patrick has so graphically pointed out, the pain is very often started by the slightest irritation of a certain localized area on the face or tongue, and occasionally by the irritation of a single tooth. These areas have been

* Read before the American Surgical Association, Washington, D. C., May 9, 1916.

described by Patrick as "doloro genetic zones" or "trigger zones," which is a good description, since the slightest irritation of one of them is comparable to the lightest touch on the hair-trigger of a gun, and explosive pain follows the irritation immediately. The cause of the irritation may be very slight, a draft of air, a touch with cotton or the lightest touch of a finger. In individual cases the pain is invariably started by irritation of the same area.

The zones from which the pain most often originates are small areas on the upper lip, just at the alæ of the nose, and on the lower lip near the vermilion border at the angle of the mouth. These two points seem to predominate over all others. The pain produced by stimulating one of these trigger zones may not be confined to the same division of the nerve as the trigger zone itself. For instance, touching the upper lip at the angle of the nose may produce pain in the lower lip, lower jaw or tongue. *Vice versa,* stimulation of the lower lip or third division may produce pain in the second. Rarely does the stimulation of one division produce pain in another that is not adjacent. This has been such a common observation with us that when treating with injections we have adopted the plan of always injecting both the second and third divisions when but one of them is affected.

Our patients have not appeared to be more neurotic than the average. Most of them had never had any serious illness and were in good health so far as could be determined from their appearance and their examinations. Infection about the teeth and face is a very usual history, but since these are common to all persons it is questionable whether they have any real bearing on this disease. It is quite possible that later investigations will show that trifacial neuralgia is an infection of the nerve branches which progress to the gasserian ganglion. At least a great many patients who have had pain in a single peripheral nerve and who have been relieved by the removal of this peripheral branch have later returned with pain in another division or in all three divisions. This makes it appear that the disease might be progressive, extending from the periphery toward the ganglion. We have no proof to corroborate this theory except that it is known that certain bacteria have a selective affinity for nerve tissue as their habitat. Examination of 6 ganglia from trifacial neuralgia cases by Wilson showed marked inflammation in all. The average age was 50.6 years. We have not felt that arteriosclerosis plays any rôle in this disease. Heredity, rheumatic tendencies or extreme nervousness has not seemed to have any influence. The fact that people who suffer agonies for years almost never become addicted to the use of morphine or cocaine (one patient

in this series addicted to both) seems to indicate that at least their mental, if not their nervous stability, is above the average.

Treatment.—The treatment of trifacial neuralgia is essentially surgical. Medical treatment is confined to hygienic measures and seems to have but slight influence in the majority of cases.

Excision or Evulsion of the Peripheral Nerve Branches.—An excision or evulsion of the peripheral nerve branches was done in 19 cases. Three were supra-orbital, 9 infra-orbital, 5 inferior dental, and 1 lingual. Letters have been received from 10 of these patients. The longest period of relief in any of the series was two years. This was a patient in whom the infra-orbital nerve was evulsed and a screw placed in the foramen. Only 5 of the patients were relieved for one year or longer. The average time of relief was 8.4 months. Some of these patients had deep injections of alcohol subsequently and, therefore, have been included among those listed later, in the discussion of that method of treatment. None of the patients treated by excision or evulsion of the peripheral branches had any complications following treatment, and there has been no mortality in this group. The method of Kanavel for blocking the foramina seems to be the most rational that has been proposed, and although we have had no experience with it, we believe it should give better results than the older methods.

Injecting Alcohol into the Main Nerve Branches at the Base of the Skull.—Several years ago we adopted the method of Levy and Baudoin for injecting the deep branches of the nerve. We have treated in this way a total of 146 patients. Letters have been returned from 120. We have followed the method of inserting the needle the average distance for each branch and then moving it a little deeper, slowly, so that when the nerve was approached the patient would receive a shock of pain over the distribution of the branch. From this it is often possible to know that the nerve has been entered, or at least approximated very closely. This is especially true if there have been no previous injections. After the shock of pain has been noted, we have injected from 15 to 30 minims of 80 per cent. alcohol. We have not become skilful enough to locate the nerve each time an injection is made. In fact, this seems to be impossible. If the nerve is entered or approximated very closely the patient will be relieved at least temporarily. As mentioned previously, the plan has been followed of injecting both the second and third divisions when one of them was affected. Occasionally some bleeding resulted, which produced considerable tension underneath the temporal fascia. In three patients,

there was inflammatory reaction of the cornea which cleared up within a few days; in two there was temporary paralysis of the external rectus muscle of the eye, and in six, stiffness of the muscles of mastication, which gradually subsided. The latter were patients who had had several injections. The length of time patients were relieved varied greatly, in one instance the relief lasting as long as five and one-half years, in another three years, and still another three and one-half years. This would seem to be very favorable. However, only 30 were relieved for one year or longer. The average length of time for the entire series of 120 from whom we have heard was 9.4 months, a slightly longer average than the time of relief following our series of operations on the peripheral branches. A discouraging feature of this method of treatment is that 77 of the 120 (64 per cent.) had relief of pain for six months or less. There has been no mortality in this series and no serious complications. More recently the injection of alcohol into the gasserian ganglion itself has been proposed. The technic of this operation has been perfected largely by Fritz Härtel of Bier's Clinic and by Urban Maes in this country. Maes reports that Härtel has injected 27 patients by this method and is satisfied with his results, reinjection rarely having been necessary. Maes himself treated his first case by this method in June, 1913, and reports lasting relief. He does not mention any other results. Up to the present time we have no evidence to show that the results following injection of the ganglion itself will be more permanent than injection of the deep branches. I can testify that isolation of sensory nerves elsewhere in the body and injection of a considerable amount of alcohol into their main trunks does not always give freedom from pain. We have no personal experience with injections into the gasserian ganglion. If this method of treatment becomes generally adopted, I feel certain that there will be many serious complications.

Operation on the Gasserian Ganglion.—Eighteen patients have had operations on the gasserian ganglion. Twelve of these were males and 6 females. The average age was forty-eight years; the youngest was thirty years of age and the oldest seventy. Thirteen of these patients had had some type of peripheral operation, and 2, previous operations on the gasserian ganglion, while all of them had had deep injections of osmic acid or alcohol into the various nerve branches for the relief of their suffering. In 9 of these patients, all three divisions were involved; in 6 there was involvement of the second and third divisions; in 2, involvement of the first and second, and in 1, involvement of the first and third. Eleven patients had the ganglion removed after the Hartley-Krause method, 1 was operated on by the

method of Abbe, and 6 by the method of Frazier. Thirteen of the 16 living patients have been completely relieved of their pain or the recurrences have been so slight that they consider their condition satisfactory.

The remaining 3 patients of this group have had recurrence. Two of these were operated on by the Hartley-Krause method and 1 by evulsion of the posterior nerve root. These recurrences must be considered, we believe, as due to the failure to remove either the entire ganglion or all of the fibres of the posterior root, a possibility in early cases when the operator's experience has not been extensive. My own experience would seem to show that enough emphasis has not been laid upon the one point of getting well behind the ganglion in order to expose all of the posterior root, especially to the inner side, before sectioning or evulsing it. I believe the failure in one instance was due to this fact.

There were two operative deaths in this series. One of them was that of a woman, sixty-one years of age, who previously had had an operation for the deep removal of the second and third divisions and later an attempt to remove the gasserian ganglion, both of these before she came under our observation. She died from late hemorrhage on the twenty-first day after operation. Undoubtedly the enormous amount of scar tissue from the two former operations was largely responsible for the fatal termination. The other patient, a woman forty years of age, never rallied from the operation, and died about twelve hours after leaving the operating room. Unfortunately a necropsy in this case could not be obtained. I am satisfied that hemorrhage was not the cause of death in this instance.

The results of operations on the gasserian ganglion, according to this series, are not entirely satisfactory, but probably this is due largely to the fact that some of the patients were operated on several years ago when experience in this work was not great. In our opinion the same number of patients operated on to-day would give approximately 100 per cent. permanent relief from pain.

The mortality in this series is much too high, and that of many a larger series of cases may be lower. However, the operation is serious and must not be undertaken too lightly. Surgeons who have not had considerable experience in surgery of the brain should not undertake the operation. The mortality as well as the permanent results may be improved only by those who have had such experience and are willing to do the most painstaking and careful work. In my own work the more gasserian ganglions I dissect on the cadaver the more I feel that it is a difficult and serious operation and that only when it is performed with

the utmost care can one feel sure that all of the nerve fibres have been removed in an individual case. At the present time evulsing the posterior nerve root or removing the ganglion entirely is the only operation insuring permanent relief, and the mortality is no higher than that of many serious operations performed daily by surgeons throughout the country. Therefore, since patients with trifacial neuralgia do not recover spontaneously and the results of peripheral operations and injections are so temporary, this should be the operation of choice for a person in reasonably good physical condition.

REFERENCES

Patrick, H. T.: The Treatment of Trifacial Neuralgia by Means of Deep Injections of Alcohol. Jour. Amer. Med. Assn., 1907, xlix, 1567–1573. The Technic and Results of Deep Injections of Alcohol for Trifacial Neuralgia. *Ibid.*, 1912, lviii, 155–163.

Lévy, F., and Baudouin, A.: Les injections profondis dans le traitement de la néuralgie faciale rebelle. Presse méd., 1906, xiv, 108.

Härtel, F.: Ueber die intracranielle Injektionsbehandlung der Trigeminusneuralgie. Med. Klin., 1914, x, 582-584. Die Behandlung der Trigeminusneuralgie mit intrakraniellen Alkoholeinspritzungen. Deutsch. Ztschr. f. Chir., 1914, cxxvi, 429–552. Gives excellent bibliography.

Maes, U.: The Treatment of Trifacial Neuralgia by the Intraganglionic Injection of Alcohol (Härtel's Method). New Orleans Med. and Surg. Jour., 1913–1914, lxvi, 183–188. The Surgical Treatment of Tic Douloureux. International Abst. Surg., 1915, xxi, 349–359. Gives excellent bibliography.

DISLOCATION OF THE FIRST CERVICAL VERTEBRA*

UNILATERAL AND BACKWARD: PRODUCED BY MANIPULATION

By A. F. Jonas, M.D.

of Omaha, Nebr.

The complicated construction of the spinal vertebræ makes it impossible for the occurrence of a simple dislocation at any point below the cervical; though the term dislocation, without qualification, of the spinal segments in the dorsal or lumbar is often used. All lesions in these regions are dislocations with fracture of some part of the vertebra, therefore the term fracture-dislocation is applicable to all of them.

On the other hand, all vertebræ above the level of the seventh cervical, on account of the very much lessened obliquity of their articular surfaces, their great mobility and the absence of ribs, admit of dislocations without fracture. Before the introduction of the Röntgen rays, the diagnosis of simple cervical dislocation was more frequent than now. In our own experience, in the few recent cases that we have seen, we have been obliged to modify our clinical diagnosis of simple dislocation to fracture-dislocation when viewed with the Röntgen ray, so that it would seem that a cervical displacement without fracture is not common. The skiagram usually revealed a breaking off of a fragment of a transverse or spinous process or a part of an articular surface. In one instance there was a fracture of a cervical body. In the writer's opinion, one or more fractures take place more frequently than is revealed even by an X-ray negative, for the reason that the greater number of the skiagrams of the spinal column, in any region, are indistinct, in fact, in many instances, the picture is more or less of a blur, giving the röntgenologist an unlimited latitude for guesswork and speculation. It is possible usually to determine that the bones are displaced, but often there is not sufficient definition to determine the existence of fracture. Therefore, the usual classifications found in text-books need revision. As the Röntgen pictures have become more accurate, the appellation of fracture-dislocation in injuries to joints in every part of the body has become more frequent. The practical bearing of this advance in diagnostic accuracy is so evident that it need not be discussed in this connection.

The majority of cervical dislocations take place in a forward direc-

* Read before the American Surgical Association, May 11, 1916.

tion, and, if they do not cause instantaneous death, which occurs in most of them, they produce cord lesions consisting of more or less compression, varying in degree from slight sensory and motor disturbances to complete paralysis involving the four extremities. A dislocation with or without fracture, producing no cord symptoms, deserves to be recorded. The usual cause is by direct or indirect violence, such as a fall on the head, a blow in the neck or head, or a heavy object falling on the head or neck.

The case to be introduced, at this time, is of some interest, because it was a dislocation without fracture, as demonstrated by a skiagram and an open operation, and, further, it was produced by manipulative effort used with therapeutic intent.

A. C., farmer, appeared on August 30, 1915, at my regular afternoon consultation hour. He entered the consultation room with his head dropped forward, face partly turned toward the right side and his chin resting on his sternum. His eyebrows were highly elevated. His neck seemed to be fixed, for he did not make the slightest cervical rotation. As he sat down in a chair and presented a lateral view, the upper end of the cervical region projected sharply backward on the occiput. His appearance suggested a destructive cervical spondylitis or an occipitocervical neoplasm. He spoke with difficulty, for it was apparent that he could separate his jaws only to a very limited extent.

He stated that he had not been able to turn nor raise his head for more than a year, and that his condition was due to a treatment that he had received at the hands of an osteopath. He had gone to this practitioner to be treated for "generalized rheumatism." He had been placed on his back on an operating-table and the treatment was begun with vigorous and forcible rotations of the head. The operator, while standing at the head of the table, had grasped the patient's head with both hands, one resting on either side of it, two fingers, the index and middle, beneath each horizontal maxillary ramus, and, while being held thus, his head was "twisted" from side to side; extreme and forcible rotations were executed, causing great pain. He suddenly felt and heard a loud painful snap in the back of his neck at the base of the skull, and his head became fixed in the position described and had remained thus to the time of his visit. He stated that his condition had become unbearable on account of the pain in the back of his neck and occiput and his inability to separate his jaws enough to enable him to eat or speak with freedom. He had an almost constant vertical headache as well as pain in his neck since the accident.

Examination.—Any attempt to rotate his head caused a marked muscular spasm involving all the cervical muscles, especially the trapezei and sternocleidomastoids. An osseous projection was not only palpable but distinctly visible in the occipitocervical space. This appeared to be a spinous process belonging either to the first or second cervical vertebra. The tip of the spine appeared to deviate to the left of the median line. It was tender on pressure and caused him to flinch decidedly. An inspection and palpation of the pharynx disclosed an irregularity and tenderness at the nasopharyngeal junction.

It was evident that we had to deal with a luxated cervical vertebra, probably the first one, the atlas. There had been no cord pressure symptoms, except for an occasional tingling of short duration in both arms and hands. There had been no motor disturbances, all reflexes were normal and a careful search for sensory changes was negative. A skiagram presenting a lateral view of the cervical spine revealed a retrodisplacement of the atlas. The space between the posterior margin of the foramen magnum and the first cervical spine was clearly increased. The condition was not clear on first inspection, owing to the fact that the spine of the second cervical vertebra is much larger and longer under normal conditions than the first, in fact, the latter is usually absent and is rudimentary, and the further fact that a dislocation at this point, without a fracture of a transverse or articular process or the axis and an absence of cord lesion, is improbable. Therefore, we evidently had to deal with a slipping forward of the head on the atlas involving the occipito-atlantal articulation. The occipital condyle, probably the left one, had slipped forward so that it rested in front of the margin of the left superior articular surface of the atlas, causing a fixed rotary anterolateral flexion of the head. The patient was informed of his condition and advised to return to the osteopath, because this class of practitioners consider themselves super-bone-setters. He declined in as vigorous English as his set jaws would permit and insisted that the writer make a manual reduction. He was informed that this was out of the question, because one could not hope to reduce a dislocation in this region that had existed more than a year, much less hope for an accidental re-adjustment, and at the same time avoid an injury to the medulla. It was agreed that an effort at manual reduction should be made and, if unsuccessful, an immediate open operation should be done.

Accordingly, under complete ether anæsthesia, guarded rotary manipulations with pressure over the prominent cervical spine were carried out and, as was expected, without results. The patient was placed in the ventral position, and brought forward on

the operating-table so that his shoulders rested on its edge and the forehead was placed on a Cushing bench. A laminectomy had been planned, for it was considered impossible to affect a safe operative replacement of the dislocated atlas after it having been displaced for more than a year. The chief object to be achieved was to remove the left axial facet as well as the lamina to enable the patient to elevate his head, so as to relieve the pressure of the chin on the chest. Through the usual posterior incision the arch of atlas, together with the left superior articular surface, was removed with a Röntgen forceps. A distinct anteroposterior movement of the head could not yet be made. While the right atlo-occipital articulation was affected only in a rotary way, and its articular surfaces were in contact and were immovable, it was decided to remove enough of the articulation to mobilize it. This was accomplished so that anteroposterior movements became fairly good. The wound was closed and dressed in the usual aseptic manner. The operative recovery was normal. The immediate operative effect was to permit the raising of the head, so that the chin was free from the chest, enabling him to masticate and speak freely. With effort the head could be elevated to a normal position, but he was not able to maintain it for more than a few minutes. There was moderate rotation. Pain and muscular rigidity had disappeared.

Dislocation of a cervical vertebra, without fracture and without cord lesions, is rare except at the atlo-occipital articulation and between the first and second vertebræ—the atlanto-axial region. In the latter case the chances are in favor of a fracture of the odontoid process. The transverse ligament usually offers sufficient resistance to bring this about. It is true, the transverse ligament may be torn from its tubercles and allow a backward dislocation of the axis. In that event cord compression would be inevitable and a fatal termination almost certain.

In our case we had to do with a unilateral dislocation without cord symptoms. Had we had a bilateral dislocation forward, a fatal cord compression could scarcely have been prevented.

The interesting feature of our case is the manner of the production of the luxation. We naturally ask ourselves, did the misplacement occur by the force of the one particular movement in which the articular surfaces parted, or was it a succession of movements that started it, little by little, stretching the ligamentous attachments and possibly tearing a few fibres with each rotation, as might be suggested by the pain and cracking experienced with each "twist" of the head, until

the last ones yielded, permitting the displacement to be complete? The operator informed the patient that all his pains were due to several misplaced vertebræ, that they were pressing on certain spinal nerves causing his " generalized muscular and articular rheumatism " and that it was necessary that the " luxated spinal bones " be replaced and, since his trouble had existed a long time, it might be difficult to effect a reduction and therefore extreme efforts might be required. Accordingly, the osteopath began to rotate the subject's head from side to side, at first without producing discomfort, then the rotations became more vigorous and with increasing pain until each movement produced a " cracking " sensation in the neck, until a supreme effort was made to reduce the imagined luxation, ending in an extremely painful " snap " leaving the head in a fixed position, establishing a real dislocation which our advanced hyper-manipulator did not recognize, for an imaginary luxation which was non-existent. A strange system of therapeutics that trains a man to see things that have no existence and blinds him to those which are tragically real. The method of manipulation and the pain experienced with the increasing force employed would suggest the belief that the misplacement did not occur with the one final decisive movement, but that the many rotations gradually prepared the peri-articular structures and the joint surfaces so that the atlas began to rotate on its vertical axis and finally slid with the last rotary effort from its articular bed to its malposition where it became fixed.

Naturally the possibility of a replacement of a dislocated atlas suggests itself. It might be accomplished in a recent case by manipulative effort. The chances for failure, however, are great and an open operation may be inevitable. External efforts may be ineffective on account of the great mass of muscular structures laterally and posteriorly. Pressure in the pharynx with anteroposterior or rotary movements, together with traction on the head, may accomplish very little when we take into account the obliquity of the articular surfaces of the atlas, especially the sharp upper articular margins. When once the occipital joint surface, which is concave-ovoid, has slipped over the sharp axial margin, nothing short of leverage would appear to be effective. The atlas, itself, is not massive, it has no body or spinous process—it is an irregular slender ring of light construction. It is located in a region rather difficult of access. It encircles a most vital structure, the medulla oblongata. It would seem that a reduction by manipulation would be as much of an accident as the force that produced

the dislocation. Operative measures in recent cases involve great technical difficulties as well as unusual danger.

In old luxations in this region, the danger and difficulties are increased so that reduction by operation is highly improbable on account of the cicatricial tissue which firmly holds the atlas in its position. Therefore in those cases where there is an absence of pain and discomfort and the deformity does not greatly interfere with general activity, non-interference will be the best plan. In cases, however, where there is great distress and malposition, the removal of such parts of the bone as will relieve the discomfort and correct in part the deformity is indicated.

A METHOD OF TREATING CYSTS OF THE BREAST*

By Francis J. Shepherd, M.D.
of Montreal
consulting surgeon to the montreal general and royal victoria hospitals

A number of years ago I was asked to assist a surgeon in an operation for the removal of the breast from the wife of a colleague. The case was supposed to be malignant, without any involvement of the axillary glands; the tumor was hard, nodulated, had been noticed for some weeks and appeared to be increasing in size; it was situated in the lower zone of the right breast. The breast was removed and on examination the tumor proved to be a simple cyst containing clear fluid; it was so full of fluid that there was no sensation of fluctuation. This case impressed me much and I then suggested to my colleagues that if the cyst had been tapped it would have collapsed and there would have been no necessity of removing the breast.

After this in any doubtful case I always put a needle into the growth; if it was cystic the fluid was evacuated and the tumor instantly disappeared, and if it was a solid growth it was easy to tell. In some cases of scirrhus the resistance and peculiar sensation conveyed enabled me to make a diagnosis. As long as the fluid evacuated from the cyst was clear I had no doubt of its non-malignancy, but if it was bloody fluid, then the case was operated upon. The following cases taken at random from my notebook will do for illustration:

Case I.—Miss D., aged forty-eight, came to me in May, 1900, complaining of a swelling in the left breast; it was painless but she felt some discomfort from it. She had only noticed it for a couple of weeks. On examination I felt a smooth, round, hard tumor in the left lower quadrant; the glands in the axilla could not be felt. I did not think it malignant, but as a matter of procedure put in a needle and immediately evacuated nearly two ounces of clear fluid. I did not see her for some time, then she told me the fluid had partially re-collected, but gave her no discomfort. I saw her a few days ago (February, 1916), she was quite well and no tumor could be detected in the breast.

---

* Read before the American Surgical Association, May, 1916.

CASE II.—Mrs. F., aged forty-five, in June, 1903, came to see me to get an opinion on her case, as a surgeon whom she had consulted told her she had cancer of the breast and it must be removed. She had a hard lump on the inner side of the left breast which she had noticed for some months; she thought it was growing. Never had an injury to the breast, or sore breast, when nursing. The lump on the inner side of the breast was of apparently stony hardness. As is my custom, I put in a needle and immediately evacuated two drachms of clear fluid. She had a little soreness and some inflammation after the puncture, but this soon subsided and the cyst never reappeared. The next year she came back to me with a similar tumor of the right breast, which was quite evidently a cyst. Some time later this was tapped and nearly an ounce of clear fluid evacuated. A rather hard base could be felt after the tapping. This patient lived until 1915 and died of some disease unconnected with the breast.

CASE III.—Miss K., nurse, aged forty, in July, 1907, came for my opinion, as the surgeon for whom she worked told her she had malignant disease and wanted to remove the breast. She had noticed the growth some time, but did not think it had grown lately. Had some time before been struck in the breast by a delirious patient. On examination, found a hard tumor apparently the size of a pigeon's egg on the inner side of the left breast. No enlargement of axillary glands. I put a needle in and evacuated about half an ounce of clear fluid. There was no further trouble and she is still well, 1916.

CASE IV.—Mrs. B., aged forty-four; married; three children, the youngest, fifteen. She was sent to me February, 1910, by Dr. H., for the purpose of having the breast removed for supposed malignant tumor. The patient never had any trouble while nursing, but a few months ago received a severe blow on the right breast. She noticed the tumor three weeks before coming to me. The examination showed a lump the size of a pigeon's egg, very hard, non-fluctuating, on the right lower quadrant of the breast. There was a small hard nodule above the nipple. A needle was put in and two or three drachms of a rather thick, milky fluid withdrawn. The tumor immediately disappeared. On March 25, 1915, she returned with the tumor above the nipple, seen on the first occasion, as a very small nodule, much enlarged. This was tapped and clear yellow serum escaped. I had not seen her after the first tapping, five years before, and had told her to come back should the nodule above the nipple enlarge. There was no trace of the first cyst tapped.

These are a few examples of the cases treated, and by this simple procedure a positive diagnosis was made and the anxieties of the patient greatly relieved and without the necessity of an operation, even a minor one. In multiple small cysts this method is of no value and the breast ought to be removed. I have seen and tapped many cases and as they never returned to me I presume they went on favorably. Many of these cases I have been unable to trace.

To Contributors and Subscribers:

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 145 Gates Ave., Brooklyn, N. Y.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS *of* SURGERY
227-231 S. 6th Street
Philadelphia, Penna.